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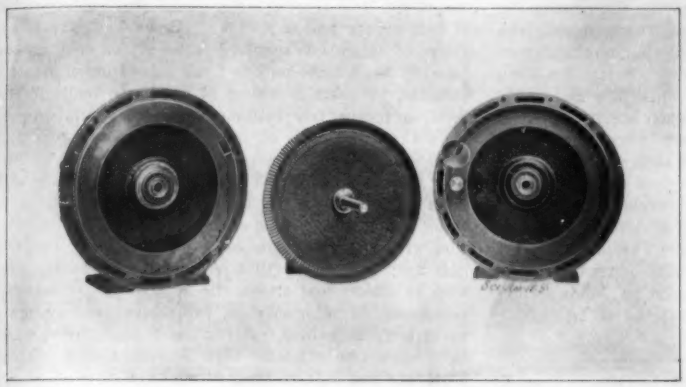
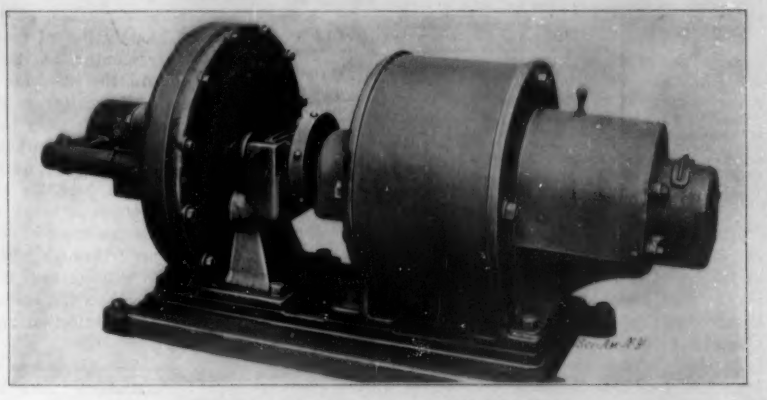
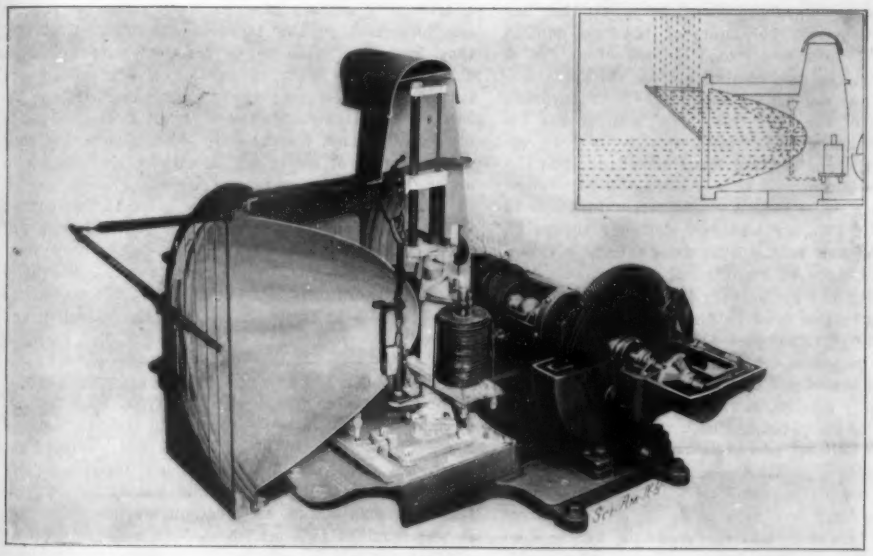


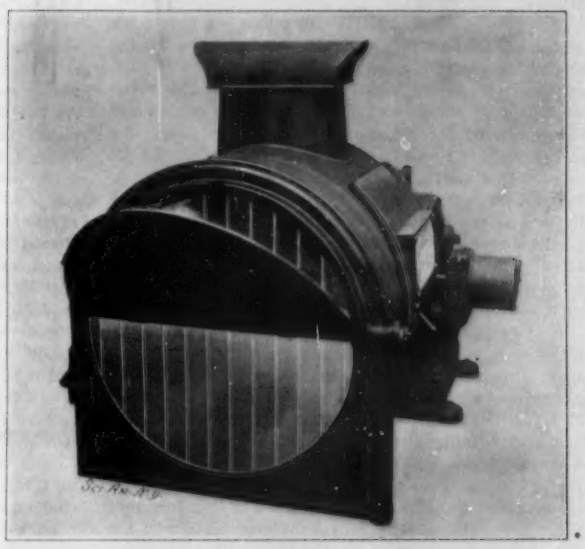
THE TURBINE ENGINE DISASSEMBLED.



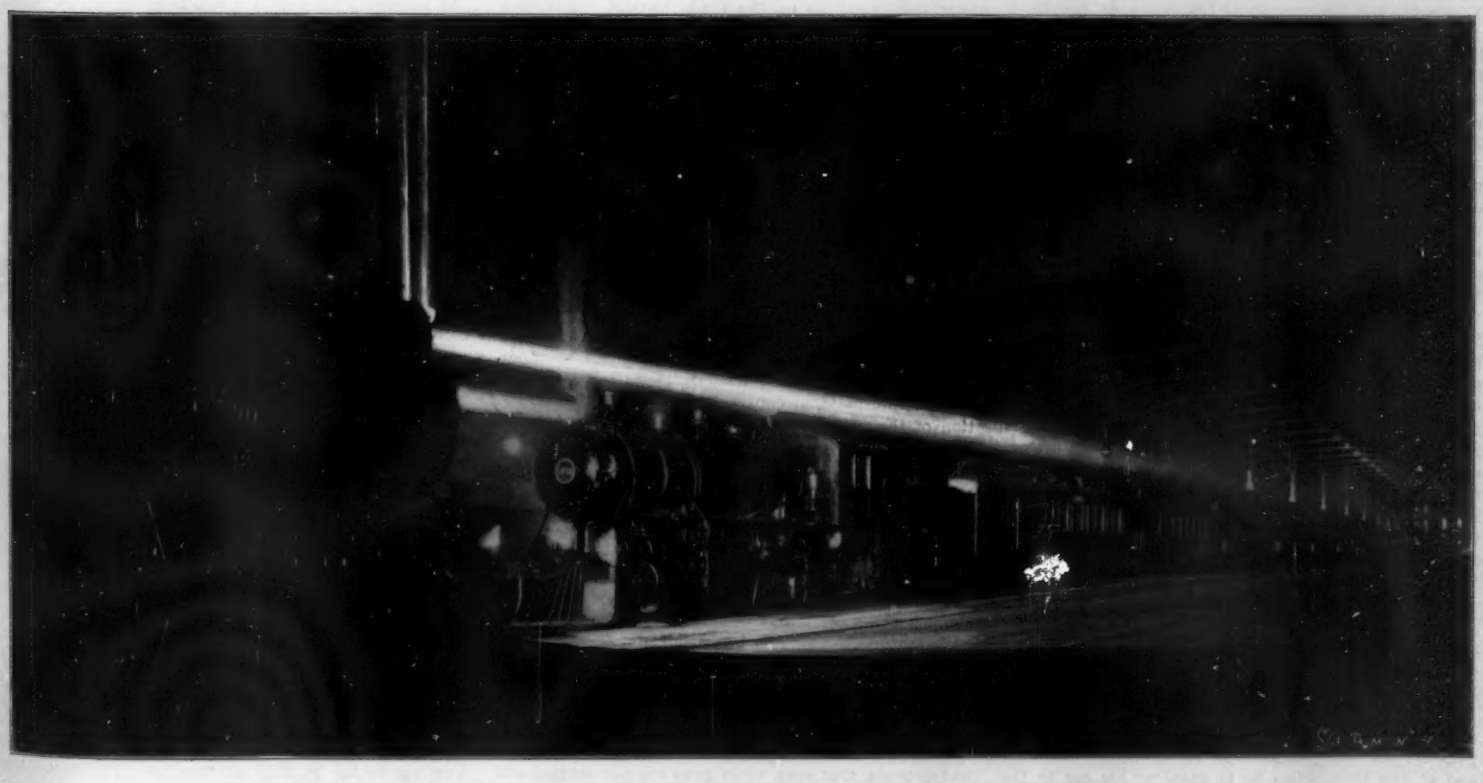
THE MINIATURE TURBINE AND DYNAMO.



A SECTIONAL VIEW OF THE HEADLIGHT.



FRONT VIEW SHOWING SHADE DRAWN.



VIEW SHOWING TWO ENGINES EQUIPPED WITH THE VERTICAL AND HORIZONTAL BEAM HEADLIGHT.—[See page 170.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, SEPTEMBER 13, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE MOTORMAN.

It was only by a fraction of a second of time that the President of the United States escaped being killed, as the result of the recklessness or stupidity of a trolley-car motorman, who, on being reproved by the Chief Magistrate of the land, proceeded to give a display of that brutal indifference and brazen-faced impertinence with which the public is only too familiar. The fact that it was the President himself who was imperiled has served to draw public attention to the general incompetency of the men who run our modern trolley cars; and the public horror of the accident, with its actual and possible consequences, is, of course, accentuated by the fact that we have been within an ace of losing a President by violence for the second time within a year. Yet, as a matter of fact, the peril of instant death which overtook the President is one which confronts hundreds, and indeed thousands, of the citizens of this country every day of the year. There is no question, and there has been no question in the public mind for several months, that the time is ripe for stringent legislation affecting the selection and appointment of men to the most important position of motorman. The companies will have to make a more careful choice; they will have to give a rate of wage for this work which will attract to it only the best and most skilled men.

It is far from our intention to cast a slight on the large and rapidly-increasing body of motormen as such; for we believe that the majority of them are careful and conscientious men who realize the dangers of their work and its enormous responsibilities, and endeavor to put their cars through on schedule time without riding rough-shod over such rights of the road as are possessed by other traffic, whether vehicular or pedestrian. At the same time, it is a fact that there are many men handling the controller who are in every way unqualified for the task. They are often ignorant, callous, and domineering, and only too ready to assert the brute force which is exemplified in the size, speed and momentum of the cars they run.

Considerations of public safety demand a thorough investigation of the whole subject of the selection and training of motormen; and in considering this question it is necessary to realize at the very outset that the responsibilities of the task assigned to the motorman have been greatly underrated. We venture to assert without fear of contradiction that the driving of a motor car at a moderate speed in a crowded city, or at the higher speeds that obtain in suburban service, calls for closer watchfulness and quicker judgment than the driving of a fast passenger locomotive on a steam railroad. A few considerations will show this. In the first place, the steam locomotive runs on a fenced-in right of way, and has the exclusive use of its own pair of steel rails; its movements are controlled by an elaborate system of signals, which is so arranged that the engineer, except in cases of extraordinary emergency, finds every provision made to assist him in controlling his train and maintaining it in its proper position relative to other trains; there are no cross streets at every 200 to 300 feet, through which other trains may come unheralded to cross his track; nor is there a mass of vehicular or pedestrian traffic that may quickly gather and surge over the track in front of him, necessitating exquisite judgment as to pace and distance if he would avoid continual arrest on the charge of culpable homicide.

The motorman, on the other hand, runs his car on a public thoroughfare; he has no signals to warn him of obstructions; no carefully marked-off distances; no home and distance signals; no clearly-painted signboards giving him the pitch of the hills, or even in some cases the curvature of the line; he has to depend on his own judgment as to speed and distance; and at any time, when he is speeding his car in the effort to keep up with the company's schedule, he is liable to find the track ahead of him obstructed by a lumbering wagon or some unsuspecting or bewildered pedestrian. We venture to repeat that of the two men the motorman holds the more difficult and responsible position; and yet we find that while in the case of the steam railroad, engineers are subjected to an apprenticeship of many years before they graduate to the throttle, and by that time are a highly intelligent and well-paid body of men, the average trolley-car motorman, on the other hand, is rushed into his job with absurdly inadequate preparation; that his pay is barely half as much as that of the locomotive engineer; and that in point of intelligence, training, and reliability, he does not compare with the men who, as a matter of fact, have the less difficult and exacting work to do.

This is all wrong, and we are paying the penalty for it in the ghastly list of tragedies which, during the last summer months, has been growing frightfully in length and in the shocking nature of its fatalities. The fact of the matter is that while the motorman had a comparatively easy task when electric trolleys were first introduced, when cars were small and speeds were low, the motorman of to-day is in a vastly different position, handling as he does a car which is two or three times as heavy and travels at nearly two or three times the speed of the car of fifteen years ago. The great peril through which our President has recently passed will not have been without its due effect, if it leads to a thorough investigation and some stringent laws on the selection and training of trolley-car motormen.

"AMERICA" CUP RACES IN 1903

The announcement that a challenge has been dispatched from the other side for a series of races for the "America" cup in the year 1903 will be welcomed by that large section of the American people that has followed with interest the history of this great aquatic contest. It has been understood for some time that a challenge would be forthcoming, so that the actual announcement has not caused any measure of surprise. At the close of the 1901 races, Mr. Watson, the designer of "Shamrock II.," absolutely refused to undergo again the anxiety and labor attendant upon the designing and tuning up of a challenging yacht. At the same time, he expressed his perfect willingness to render to Mr. Fife, or whatever designer should be chosen for the new boat, all the assistance at his command, and to place at his disposal the valuable data acquired during the preliminary investigation and subsequent construction and sailing of "Shamrock II." The designing of "Shamrock III." has been intrusted to Mr. Fife, who also designed the first "Shamrock"; and it is now announced that the plans have been completed for many months, and that a start on the actual construction of the yacht has been made by the Denny Brothers, the builders of "Shamrock II." Sir Thomas Lipton seems to have learned one of the most important lessons of his previous failures, namely, that a challenger to have any reasonable chance of success must be put into the water many months earlier than previous challengers have been, so as to give ample time to tune her into racing condition. It is expected that the new boat will be launched by the end of the year and tuned up on the Clyde against "Shamrock I." From the Clyde, if the programme is followed out, she is to be taken to the Mediterranean for the spring season, after which she will make an early start for this country, where "Shamrock II." will have been launched and put in racing trim to meet her in a series of tuning-up trials off Sandy Hook. If the plans for the challenger, as thus outlined, can be put through, the new yacht will not enter the races as an untried boat. She will have had an opportunity to measure herself against two previous challengers, and will also have had the advantage of sailing a series of races over the Sandy Hook course, under conditions identical to those which obtain in the actual cup contests. We welcome the announcement that there is to be another series of races; for in the whole field of sport there is none so dignified, none with so clean a record, and none that is marked by more friendly characteristics than that of international cup racing. While the construction of the yachts themselves has come to be a question of science and good mechanics, the handling of the yachts allows to-day, just as much as it did half a century ago in the days of the good old "America," a broad field for the exercise of the sailing skill of the skipper, and the smartness and agility of the yacht crews.

THE DEFENSES OF LONG ISLAND SOUND.

Much cheap satire has been leveled at our army and navy during the past two weeks in connection with the game of war which has been played off our North Atlantic coast—satire which has merely served to measure the ignorance of the would-be humorist of the true meaning, scope and usefulness of these maneuvers. In the first place, it is a fact which the layman too little understands, that even when guns are not shotted and mines and torpedoes are harmless dummies, it is possible to simulate the conditions of actual warfare with a close approach to actual conditions. Naval experts who have given a lifetime to the theoretical study and actual practice of war have been able to draw up a scale of points by which in mimic warfare they can assign to a battleship or a fort a close approximation to the amount of damage inflicted or received. Of course, when it is laid down that if a warship carrying 6 inches of side armor comes within 2,000 or 3,000 yards of a fort armed with 12-inch guns, and is discovered and fired upon, the vessel is put out of action—it is assumed that at such a close range a 12-inch gun will find its mark. In an actual fight, it might do so, or might not. Again, if a fleet of half a dozen torpedo boats can creep up in a fog within striking range of a battleship, and discharge their torpedoes, it is reasonably assumed that such a vessel is sent to the bottom; and so, throughout the whole range of operations involved in an attack such as has recently been made on our Long Island defenses, it is possible, by using a system of points, to reach in the total, a pretty fair estimate of what would happen were the ships those of the enemy, and the guns and torpedoes loaded to destroy.

Of the value of these maneuvers to the ships and forts themselves there can be no question. Everything is present during a sham fight except the destruction wrought in the ship or fort itself by the enemy's gun fire; and surely that is worth much in training both to officers and crews. So also, to judge from the standpoint of defense, most valuable experience must necessarily be gained, say, by the Signal Corps, when they know that a hostile fleet is endeavoring to force a passage and that on their eternal vigilance and early finding of the enemy will the result of the operations greatly depend. Similar maneuvers are carried out every year by the great navies of Europe, and for a quarter of a century or more have formed a regular and important part of the year's routine. Evidently they have proved to be of practical value, else, on account of the great expense involved, they would surely have been long ago discontinued. Of the result of the maneuvers themselves, it is impossible to offer any opinion for the very good reason that they are a matter of secret official record, and known to no one outside of government circles. The publication of these results, which will take place in due course, will be made probably through the official journals of the army and navy, and they cannot fail to prove most instructive reading. For the present it is sufficient to say that the ordinary press comment on the maneuvers is necessarily as futile, as much of it is foolish and misleading.

ELECTRICAL TREATMENT FOR LEAD POISONING.

An installation of electric baths for the treatment of lead-poisoning in the pottery industries of England has been carried out at Stoke-on-Trent. One of the most prevalent maladies contracted in the pottery factories is lead poisoning, and paralysis, and the complaint has become so great during late years that it was resolved to establish electric baths, since electro-therapeutics is conceded to be the only efficacious means of combating the disease. The installation provides for continuous and alternating-current baths. The necessary current is taken from the street mains to charge a large accumulator, which is capable, when fully charged, of working the baths for fifteen hours. The accumulator is controlled by a switch which completely isolates it from the bath apparatus when charging, and so avoids any possible connection between the high potential of the current from the street mains, which is utilized for the tram-car service, and the baths. A pair of wires are run from this switch to a board, where they are divided up into six pairs. One pair is for the machine that converts the continuous current from the accumulator into an alternating current; one pair goes to the controlling board for the large bath; two other pairs go to two arm baths, and the remaining two pairs are in reserve. The machine consists of a motor and a dynamo coupled together, and running at 3,000 revolutions per minute, this high speed being necessary in order to obtain the requisite number of alternations per second of the current. The alternating current is carried by a pair of wires from this dynamo to a board, where they are divided into five pairs, one pair being for the large bath, two other pairs for the two arm baths, and the remaining pairs are held in reserve. Thus there are four wires going to each controlling board, two carrying continuous and two alternating current. By means of a switch on these boards either the alternating or the continuous current can be turned on to the bath as required. A regulator is mounted on the boards for adjusting the current to the proper potential, and on the controlling board for the large bath a voltmeter and an ammeter are attached. The current is passed through the water in the bath from two tin plates, one at the head and one at the foot, a third plate like a paddle being provided to concentrate the current on any particular portion of the patient's body. The Roentgen rays are worked from an induction coil, capable of giving a 10-inch spark, the current being

supplied from a separate set of portable batteries. This apparatus is in a separate room from the baths, and partitioned off by heavy curtains to exclude all light, and by its use many surgical questions have already been decided which have resulted in the relief of much suffering. It is hoped that this electrical treatment will prove a panacea for lead-poisoning, and for other muscular, nervous and rheumatic affections.

NEW WAYS OF MEASURING WATER.

Director Samuel Fortier, of the Montana Experimental Station, gives out some very interesting information for the use of every farmer who is compelled to irrigate his land in order to grow crops.

The standard unit for flowing water in Montana, as well as in most of the Western States and Territories, is a solid or cubic foot of water, moving at the rate of a lineal foot in one second of time, says Mr. Fortier. Each foot in length of a flume one foot wide and one foot high (inside measurement) flowing full of water would contain a solid or cubic foot of water. Now, if this flume were placed on such a grade that the average rate of flow of water within it would be just one foot of distance for each second of time, it would carry a volume equal to the standard unit. This is often abbreviated into the two words second-foot.

In considering this standard for flowing water, irrigators should not conclude that a volume of a certain definite size is necessary. It will be apparent to all that a flume six inches wide and six inches high full of water flowing at the average rate of four feet per second should also deliver one cubic foot per second. In general, the flow of any stream may be obtained by multiplying the width and depth of the water channel in feet by the average rate of flow in feet.

For small streams of water such as are applied to orchards and garden tracts the miners' inch is a convenient unit, and there are advantages in continuing its use. In adopting a new standard the members of our State Legislature pursue the extended use of the old unit and so defined it in accurate terms. Forty Montana miners' inches are the exact equivalent of one cubic foot per second. An irrigation stream containing eighty miners' inches would be described as two second-feet by the new standard, one containing one hundred and twenty miners' inches as three second-feet and so on.

The second-foot and the miners' inch can only be used for water in motion. It is often convenient in irrigation to describe a certain volume of water in a state of rest. The cubic foot might have been adopted for this purpose had it not been too small. It would have been but a drop in a bucket when compared with large quantities used in irrigation. Accordingly the acre-foot has been quite generally adopted.

This unit represents the quantity of water which would cover an acre to the depth of one foot. Since there are 43,560 square feet in an acre, an acre-foot contains 43,560 cubic feet. Rainfall is measured in depth over the surface, and of late years the tendency has been to measure water for irrigation in the same way. One frequently hears it stated by practical irrigators that 40 acres of spring wheat will require 40 miners' inches. But this statement conveys no definite idea as to the actual amount of water applied to the wheat field, because the number of days the stream has been allowed to run on the field is not given. When, however, one states that 60 acre-feet were applied in two irrigations it shows that at certain stated periods this volume was sufficient to have covered the 40-acre field to a depth of 1.5 feet.

How much water does it require for one irrigation? The amount will, of course, vary with a score or more of conditions. It may interest the reader to know that of forty-four experiments made by the Montana station in different parts of Montana the average was 10 inches of water over the surface irrigated. This amount included all waste incurred on the field, but did not include the losses in conveying the water from the natural channel to the borders of the field. I have found that with well-made field laterals and skilled irrigators 6 inches of water will suffice to wet the soil to an average depth of one foot.

Throughout the irrigated portions of Montana 40 acres of land with 20 miners' inches of water will produce more than 80 without water. If this be true, and the statement would seem to be extremely conservative, a miners' inch of water, apart from the cost of irrigation, is equal in value to two acres of land. Still one finds that land is measured and mapped, and when sold the purchaser is careful to see that the deed is valid and properly recorded. Whereas, in the case of irrigation water probably less than 5 per cent of the total volume used in the State has ever been measured.

I am often asked to explain the new way of measuring water. The Montana Legislature has prescribed no new method. It has merely adopted a standard unit in which all volumes of running water are hereafter to be expressed. The citizens of the State may measure irrigation water by any accurate method, provided the results are expressed in cubic feet per second.

Of late years small instruments called current meters have been manufactured by several firms at prices ranging from $50 to $200 each. These meters indicate the velocity of the water in any open channel by the mean velocity. When multiplied by the area of the section they give the discharge. This mode of measuring water has become quite popular owing to the ease and rapidity with which it can be done, and also the fact that fairly accurate results can be obtained without the use of flumes, boxes or other devices.

A weir box usually consists of a flume with the lower end inclosed. In the middle of the top of the lower end a notch is cut, through which the water to be measured flows. Weirs require no instruments other than a foot-rule; they are easily and cheaply made, and measure flowing water within 2 per cent of accuracy when all the requisite conditions are fulfilled. Weir boxes as compared with miners' inch boxes are more accurate, can be built for the same if not for less money, and can be used to measure much larger volumes. The chief defects of this device are that the box often fills with sediment, which must be removed, and that the water as it issues from the notch requires a drop of at least the depth of water flowing through the notch.

For nearly half a century Western irrigators have tried to devise a way by which water might be measured as it flows through a headgate. They hope to make one structure answer two purposes. In this they have failed, for the reason that the water is so much agitated and so irregular in flow as it passes through a headgate as to render it impossible to secure an accurate measurement. Of late years measuring boxes have been placed at the most suitable points below the headgates, and the latter control the stream while the former indicate the volumes. This rule applies to weirs. It is well to have a space of at least 50 feet between the two structures, and if a better site can be secured further down the ditch the intervening distance may be increased to several hundred feet.

The weir box should be placed on a level in both directions, having the floor at the lower end on a level with the bottom of the ditch. The ditch banks above the weir box should be raised in order that the water may flow through the notch in the weir board. When the weir box is in position the apron is inserted in front and moist earth carefully tamped round the side. The ditch for a distance of 50 feet or more above the weir box should be regular and equal in depth and width to the inner dimensions of the box. Care must be taken that no water escapes either beneath or at the sides of the box.

The method to follow in measuring water in a weir can best be shown by examples. Let us suppose that a farmer has made and placed a box similar to the above. After turning in the water and allowing it some time to attain a uniform flow he proceeds to the weir box and with an ordinary rule measures the depth of water flowing through the water notch. Bear in mind that this measurement is not made at the weir board, but at the regular gage, whether it be a nail, brass plate or post, as described under that head. We will assume that the depth as found by the rule is 3.5 inches. Now by referring to the table he

DISCHARGE OF FARMERS' WEIRS OF DIFFERENT LENGTHS EXPRESSED IN MINERS' INCHES.

Depth of Water on Crest.	1 ft. weir.	1½ ft. weir.	2 ft. weir.	3 ft. weir.	4 ft. weir.	5 ft. weir.	6 ft. weir.	7 ft. weir.	8 ft. weir.	9 ft. weir.	10 ft. weir.
In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.	Min. In.
1	3	5	6	10	13	16	19	23	26	29	32
1¼	4	6	8	12	16	19	23	27	31	35	39
1½	5	7	9	14	18	23	27	32	36	41	45
1¾	5	8	10	16	21	26	31	37	43	47	52
2	6	9	12	18	24	30	36	42	48	54	60
2¼	7	10	13	20	27	34	40	47	54	60	67
2½	7	11	15	22	30	38	45	52	60	67	75
2¾	8	12	17	25	33	42	50	58	67	75	83
3	9	14	18	27	37	46	55	64	73	83	92
3¼	11	16	22	33	44	55	66	77	87	98	109
3½	13	19	26	38	51	64	77	90	102	115	128
3¾	15	22	30	44	59	74	89	103	118	133	148
4	17	25	34	51	68	85	102	119	136	152	169
4¼	19	28	38	57	76	95	114	133	152	171	190
4½	21	32	42	64	85	106	127	149	169	191	212
4¾	24	35	47	71	94	118	141	165	188	212	235
5	26	39	52	78	104	130	155	181	207	233	259
5¼	28	43	57	85	114	142	170	199	227	255	284
5½	31	46	62	93	124	155	185	216	247	278	309
5¾	34	50	67	101	134	167	201	235	268	302	335
6	36	54	72	109	145	181	217	254	290	326	362

follows down the first column until 3½ is reached. The weir used is 1 foot, and under the column marked '1-foot weir' and opposite the figure 3½ already found he finds the number 21, which indicates the number of miners' inches flowing over a 1-foot weir when the depth of water is 3½ inches. If the depth had been 4 inches, the flow would have been 26 miners' inches; if 6 inches, 48 miners' inches, and so on.

THE DEATH OF PROF. VIRCHOW.

On September 5, Prof. Rudolf Virchow, the Nestor of German pathologists, passed away. Only on October 13 last he had celebrated his 80th birthday.

Virchow was born at Schievelbein, Pomerania, in 1821, the son of a shopkeeper. After an education in the school of his native village and at the gymnasium of Köslin he graduated at the age of 21 as a Doctor. Soon after became an Assistant Professor at the Charity Hospital of Berlin. In 1847 Virchow became a Professor at the University of Berlin, and two years later accepted the chair of Pathological Anatomy at the University of Würzburg. Before his Würzburg appointment Virchow had won his spurs as a Government Scientist in a mission to investigate the epidemic of typhus fever among the starving Highlanders of Silesia. His report attracted attention to him, and at once opened not only his pathological but his political career.

Not content with devoting his energy to scientific investigation, Virchow early entered political life, distinguished himself as an enthusiastic ultra-liberal.

Associated with Reinhardt, Virchow founded the Archives of Pathological Anatomy and Medical Clinic, the Medical Reformer, and a democratic club, of which he was the leading orator. He was elected to the National Assembly, but could not take his seat because he was under age, and likewise lost his chair in the Berlin University. He left Würzburg in 1856 to return to Berlin.

Passing over his active political career, and proceeding to his scientific attainments, it must be stated that Virchow never became a practitioner of medicine to any extent, but the teacher of practitioners. His memory will live in the annals of medicine for the research which he carried on in physiology, pathology, and ethnology. Among his works are: The Rheumate Cornea, Phlebitis, Thrombosis, Embolism, Cellular Pathology, Morbid Tumors, Amyloid Degeneration, On Typhus in Hungary, Lectures on Life and Disease, Nourishment and Well-Being, A Handbook of Special Pathology and Therapeutics, Collections of Contributions of Scientific Medicine, The Movement in Favor of Unity in Scientific Medicine, Origin and Coagulation of Fibrin, White Blood Corpuscles, Inflammation of Blood Vessels, Contributions to the Pathology of the Skull and Brain, Granular Appearance of the Walls of Cerebral Ventricles, Cretinism, and New Formation of Gray Cerebral Substance.

Virchow's greatest discovery was the self-propagating power of the cells in animal tissue, showing that whatever acted upon a cell from without produced a change, either chemical or mechanical, in the cell structure. These changes were the cause of disease. When Pasteur first made his startling discoveries of the bacteriological origin of disease, it was thought for a time that Virchow's theory was unfounded. But later research showed that the two doctrines really supplemented each other. The debt which physicians owe to Virchow can be no better illustrated than by stating that the modern practitioner starts with the work of Virchow, whereas the great German scientist had to beat his own path and evolve new pathological theories. Pathology as we know it to-day is Virchow's work.

Something of the man's personality may not be without interest. As a parliamentarian, he made for himself many a distinguished enemy. Indeed, so bitter were his attacks on the government that he was once challenged to a duel by Count Bismarck. In war Virchow saw most of the causes of political disease. For that reason the Kaiser once snubbed Virchow with royal ostentation, by writing to another scientist a letter, complimenting him upon his good sense in keeping out of politics. It was Virchow who coined the word "Kulturkampf," the wars of civilization.

Virchow lived to a ripe age on five hours sleep a night. His luncheon consisted only of beer and two sandwiches. The floor of his workroom was usually littered with skeletons and skulls. As a pathologist he naturally became an ardent collector. In his museum were 20,000 pathological specimens. He had a bacteriological laboratory which was both large and well equipped.

On the occasion of his eightieth birthday, which was celebrated enthusiastically throughout the world, Dr. Mommsen said: "You have broken new ground and laid new foundations for medical science. Your name is written boldly upon the tablets of history, and is honored far beyond the borders of the Fatherland." It was on the occasion of this anniversary that Prof. Virchow told a delegation of Americans that he would repay their visit when he was ninety years old.

MALLEABLE GLASS.

It has long been the effort of the glass-makers to produce a glass that would have all the clearness and beauty of ordinary glass, and at the same time possess a toughness which would render it as little liable to fracture as many of the other manufactured articles of use and beauty. It is well known that the ancients discovered and made use of a process of manufacturing malleable glass; and in the glass-making world, it has naturally been expected that it would be in the old world that the process would sooner or later be reinvented. It is to an American, however, that the

CRIMPING LAMP CHIMNEYS OF MALLEABLE GLASS.

credit of having discovered the method of making malleable glass is due. Mr. Louis Kauffeld, of Matthews, Ind., has succeeded after many years of endeavor in producing a glass which will withstand extremely rough usage without breaking. Although the process is not known to anyone except the inventor, he has stated that the lime and lead which are used in the manufacture of ordinary glass do not enter into the composition of his malleable ware. The secret lies principally in the chemicals which are used and the proportion of ingredients which form the compound, although the furnaces and crucibles play an important part in the process.

The two chief things to be avoided in connection with the crucible are intense and prolonged heat from without and the corrosion of the raw materials within —two dangers of which nearly every glass-maker knows the ruinous effect. The effect of corrosion is readily proved by heating for a long time in a small crucible such substances as borax, red lead, or potassic or sodic carbonate. After a crucible has been in constant use for several months, and especially if it has contained flint or lead glass, the back and body will be found to be covered with innumerable small dents, which have undoubtedly been formed by corrosion.

The complaint so commonly heard of specky glass arises from the presence in the glass of white particles of an infusible aluminate formed by the combination of the alkaline or metallic ingredients of the glass with the alumina of the crucible. If the corrosion becomes concentrated at one point and prolonged for a considerable period a breach is formed, through which the molten glass escapes into the furnace.

Knowing the dangers that have to be encountered in this way, Mr. Kauffeld is extremely careful in the selection and preparation of the clay as well as in the construction of the crucibles. The finely sifted raw clay, on its arrival at his manufactory, is mixed with a proportion of burnt clay considerably coarser in grain, varying in amount from one-ninth to one-fifth of its weight. The coarser particles tend to bind the clay and render the finished crucible less liable to crack from variation of temperature. Only those who have lost in this manner a valuable compound can appreciate what an important part the crucible plays in the glass-maker's success.

The tests which the inventor will make for anyone who cares to visit him in his shop in Matthews are certainly conclusive.

For instance, a chimney was placed in a pail of ice water, and after having remained a sufficient length of time to become as cold as the water, was taken out and immediately placed on a lamp with the blaze turned as high as possible. The blaze on the wick was turned so as to flow directly on the chimney, and the smoke which collected on the chimney ran down with the water without injuring the chimney. Next a chimney was placed over a small gas stove containing clay bricks used in heating such stoves. The fire was turned on full, the chimney remaining on the bricks. The fire finally brought the temperature to such a stage that one side of the chimney was drawn in and dropped down, and no crack was shown in the glass; but for a slight roughness on the outside, the glass was as clear as when placed in the fire.

Another test which was made was to place cold water in the chimney and hold the same over a fire until the water boiled. A large bulb was blown from the glass and filled with about one pint of water. It was then placed over the fire and allowed to remain there until it had boiled dry without apparent effect on the glass. Four chimneys were taken from the packing room and dropped one by one into a pail of boiling water. The chimneys were then hastily shifted into a pail of cold water that had just been drawn from a well, and the glass was not broken.

A further test was made by nailing up a box containing glassware, every nail being driven in by hitting it with a chimney. The most remarkable feat of all was the making of a perfect lamp chimney by using a chimney as a mold and blowing hot glass into the same. Both the new chimney and the mold came through the test perfectly whole, uncracked and unscarred. In appearance this malleable glass is much like the common product; it is, if anything, a little clearer than the glass now in use and in its molten state is much more elastic. It can be made of the thickness of a sheet of paper or as heavy as any in use, but in every instance it is tough—a dainty table glass could be handled as roughly as a skylight and no harm result. The advantages conferred by this toughness, in the wide variety of glass utensils for domestic use, are very numerous.

USING A CHIMNEY AS A HAMMER.

German Naval Marksmanship.

If reports which reach us from Europe are to be credited, the German sailor is not far behind our own American bluejacket in marksmanship. In target-practice the "Kaiser Friedrich III." opened with her 15-centimeter quick-firing guns on a floating target towed by the cruiser "Hela." Hitherto five or six shots a minute, with four or five hits, have been held to be a good record for each gun. But the "Kaiser

TURNING A MALLEABLE GLASS CHIMNEY.

Friedrich III." fired eight shots a minute, and all were hits. Then the two ships steamed away from each other at full speed, while the battleship opened fire with her 24-centimeter guns, her 8.8-centimeter quick-firing guns, and with her machine guns. The results were almost equally satisfactory, as there were only isolated misses, and the target was very soon knocked to pieces; a second target was then brought up, and also at once destroyed. The "Kaiser Wilhelm II." fired on August 19, and the winner of the Kaiser's prize will not be settled until the fleet maneuvers are at an end.

What is said to be the largest and heaviest anchor ever made was recently forged at the Charlestown, Mass., Navy Yard. It weighs over eight tons and cost nearly $2,000. It is 15 feet long over all and 9 feet 6 inches wide over the points. The palms are 32 inches wide. The cable for this anchor is unique also, as regards weight, each link weighing 60 pounds; 360 fathoms (2,160 feet) of it are to be supplied.

FORMING A CHIMNEY.

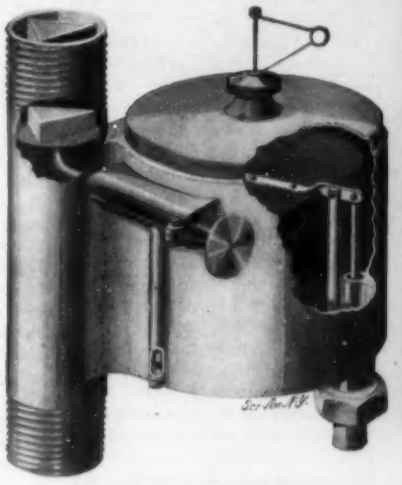
THE LOOMIS CARBURETER AND MUFFLER.

The two essentials in a gasoline vehicle are a reliable carbureter for positively feeding the engine with the gasoline and a muffler which will efficiently muffle the noise of the exhaust and at the same time avoid any back pressure on the engine piston. Our illustrations show articles of this description which have stood the test of experience perfectly, having been in use for some time on vehicles manufactured by the Loomis Automobile Company, of Westfield, Mass., and first exhibited at the 1900 New York Automobile Show. Their vehicle was considered by many as being the lightest, neatest, and most highly powered for its size of any exhibited at that time.

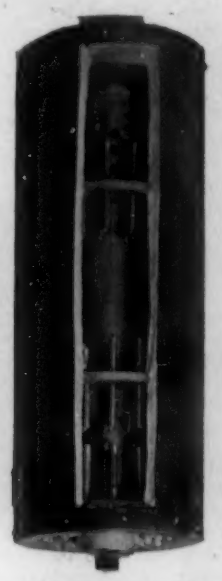
The carbureter, as improved by the inventor Mr. G. J. Loomis, is constructed on the well-known atomizing principle, having a float feed chamber in the larger portion, the inlet of gasoline to which, located on the exterior, is controlled by a needle valve attached to the underside of a cork and aluminium float.

The float maintains the level of the gasoline in the small vertical tube on the outside of the float chamber at the point where the horizontal tube crosses it. In the horizontal tube is a needle valve, which is set once for all at the proper point by rotating the thumbscrew shown to the right or left. The needle valve, when thus set, can be locked by the small set-screw. When the motor is turned over it aspirates air through the large vertical engine supply pipe, and this air, rushing upward past the small nozzle, draws up sufficient gasoline to make the explosive mixture. The gasoline thus sprayed upon the fine wire gauze directly over the nozzle is thoroughly atomized and absorbed by the air, so that it enters the motor a perfect gas and not, as in some other forms of this device, a moist spray.

In starting the motor the carbureter is "primed" by striking the small pin on top of the float chamber sharply a few times with the finger. A larger amount of gasoline is thus admitted than is necessary, flooding the chamber to such an extent as to cause an overflow into the suction pipe, where the gasoline falls on fine wire gauze located below the nozzle. To secure the most efficient results the carbureter should be located in such a position as to have warm air drawn in past the feed nozzle, and it is generally placed if possible directly over the exhaust pipe of the motor. Although the air is hot when it enters the suction pipe, the top of the latter above the carbureter will be found nearly ice cold when the apparatus is in operation, so great is the absorption of heat occasioned by the rapid evaporation.



THE LOOMIS CARBURETER.



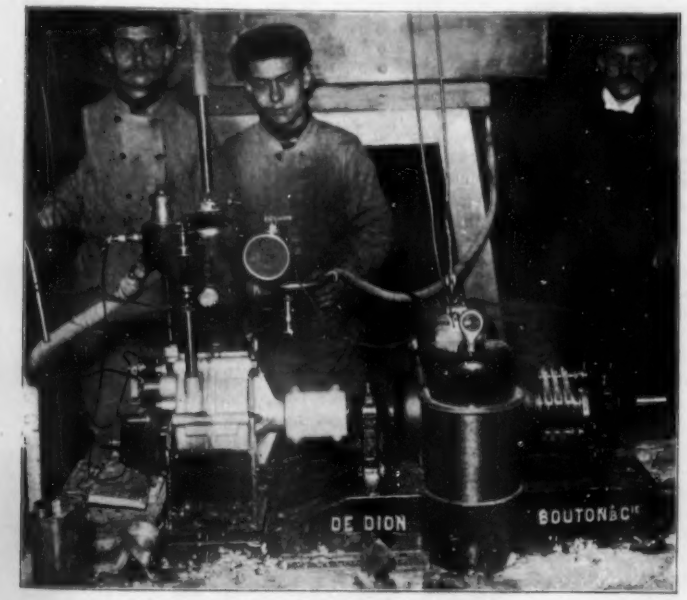
THE LOOMIS MUFFLER.

The construction of the Loomis muffler can readily be seen from the illustration also. It is planned in a special way for the purpose of breaking up the sound waves as much as possible, and yet avoiding right-angled turns in the muffler and thus preventing any back pressure or choking of the exhaust. The exhaust burnt gases enter at the lower end of the central pipe, and, cushioning themselves against the upper end, rebound and pass through holes in the pipe into the first or lower chamber. From there they are carried through numerous small pipes to the center of the second and third chambers respectively, after which they pass out into the air. By thus conducting the gases from the center of each chamber through tubes, instead of simply letting them pass through holes in the separating partitions, the gases have a chance to expand and pass through quietly, instead of with the whistling sound common to some mufflers. The area of the tubes connecting the chambers is an eighth larger than that of the exhaust pipe, while that of the holes of the exhaust pipe is twice as great as the area of the latter. The result is that there is little or no back pressure developed, while the sound of the exhaust is deadened by the outer aluminium shell and asbestos packing between it and the inner shell of sheet metal. The mufflers have been used successfully on large marine and stationary engines and have proved very effective in deadening the noise of the exhaust.

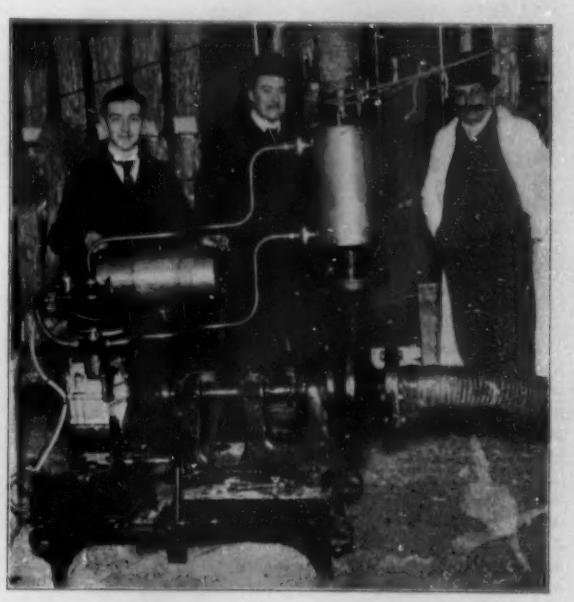
VARIOUS APPLICATIONS OF THE GASOLINE MOTOR.

BY PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

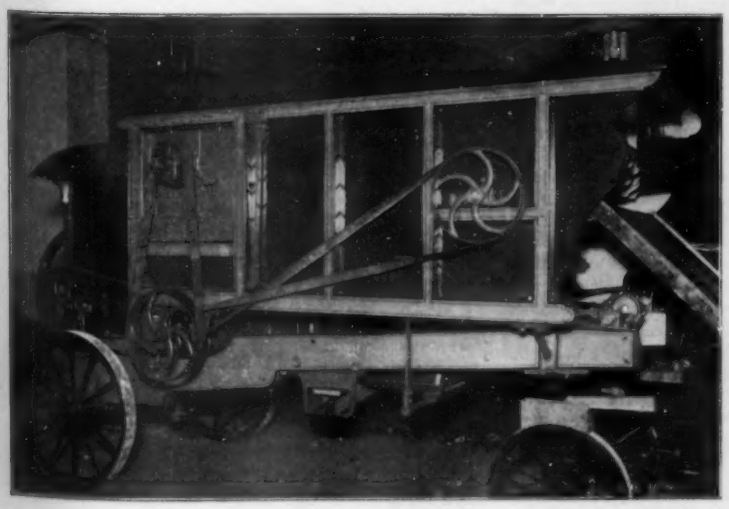
It is not difficult to foresee that the automobile motor of the gasoline type, designed as it is for lightness combined with maximum power, is soon to find its application as a fixed motor in various kinds of industrial work, especially in the form of small and compact groups in which the motor is directly coupled to dynamos, pumps and various machines. A number of newly-designed groups of this kind were brought out at the last Paris Automobile Show, and the constructors seem to be fully aware of the extensive application which the gasoline motor is likely to have, especially in plants where a fixed motor of the usual type would be too heavy and cumbersome. The De Dion Company seem to have taken the lead in the construction of light industrial groups of this kind and have especially studied the application of their motor in agricultural works. The first photograph shows a motor of this form coupled directly to a small dynamo. The motor is of the usual automobile type, except that it is water-cooled, the cylinder being surrounded by a water jacket in which there is a constant circulation by the pipes seen on the right and left. The characteristic feature of the system is the use of an electric regulator which is attached to the motor. It acts on the voltmeter principle, and when the voltage tends to rise above the proper point a simple electro-magnetic throttling device acts upon the supply pipe of the motor and thus



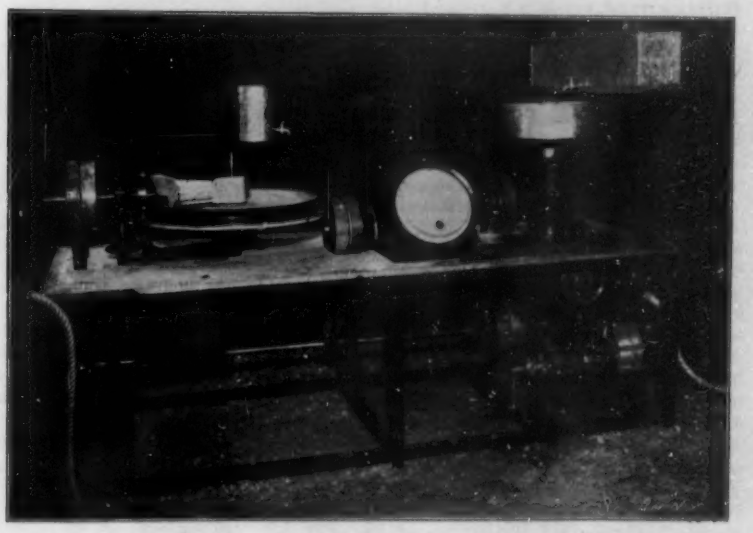
DE DION MOTOR AND DYNAMO GROUP.



DE DION MOTOR AND CENTRIFUGAL PUMP.



AN AUTO THRASHING MACHINE.



DAIRY PLANT AND GASOLINE MOTOR.

diminishes the speed. This method, which is simple and ingenious, does away with the usual rheostat regulation of the dynamo, and in fact the little group works with a remarkable regularity and is thus well adapted for arc and incandescent lighting, charging accumulators, and especially the batteries of electric automobiles. It may be used also for operating agricultural machines by means of a pulley fixed on the end of the shaft. In this case the dynamo works without load, but its voltmeter action still continues and it regulates the speed of the motor. The different uses of such a light and convenient plant need not be dwelt upon; its fitness for laboratories, domestic lighting, arc projectors, out-of-door work, farm use, etc., is at once apparent. The consumption for a 4 horse power group of this kind, giving 110 volts and 20 amperes, is reckoned at 0.5 gallon of gasoline per hour; this corresponds to 40 lamps of 16 candle power, or 60 of 10 candles. Counting the gasoline at $0.30 per gallon (in France), the consumption for a lamp of 10 candle power is only $0.002 per hour, and with larger motors it is still smaller.

Another view shows the same type of motor coupled to a centrifugal pump. The pump is placed, with the motor, on a cast-iron base in the interior of which is a space for the induction coil of the igniter. Above is the cylindrical gasoline reservoir, and on the right a second reservoir which supplies the water for cooling the motor. The speed of the motor is in this case about 1,400 revolutions per minute. It is started by the crank and chain-wheel arrangement seen in front. A pump of this kind is well adapted for agricultural use, especially for irrigation, also for drainage and domestic supply. It would render good service on shipboard and in many other applications, and on account of its small space and weight it can be easily mounted on a carriage and made portable. Pumps of this kind are now built from 1 to 8 horse power and will deliver from 2,000 to 30,000 gallons per hour. A number of pumping plants have been designed for furnishing villages with drinking water in different parts of France, and especially in Normandy.

Two other applications of the gasoline motor for agricultural use are shown in the engravings. The first of these is a thresher of the Foulon-Blondeau type, worked by a small motor which is concealed from view in the photograph. The advantage of this plant over most of the motor-driven threshing machines is that the motor, instead of being installed upon a separate carriage, is mounted directly upon the thresher and the plant is thus easier to transport. The dairy outfit was one of the interesting features of this section. The whole is installed upon a table; below is the motor, which is belted to a common shaft from which the different devices are operated. To the right is the cream-separator, then a barrel-churn worked from a second pulley and last a butter-worker with a corrugated cylinder, which moves over the revolving table.

HEADLIGHT WITH A VERTICAL BEAM.

A new type of headlight which has recently been put in service by the Chicago, Milwaukee and St. Paul Railway, promises to have a very extended application among the railroads of this country. It is an electric headlight which, in addition to sending a powerful ray along the tracks in front of the engine, also projects a powerful vertical beam. The vertical beam makes a very decided illumination in the heavens, so much so that it is possible not only to detect the presence of an engine, but also in many cases to follow its path and determine in which way it is heading. An engineer is by this means placed in touch with the movements of other trains in his vicinity, and is enabled to detect their presence where, if they carried ordinary horizontal beam headlights, he would be unaware of their location. Of course, the modern refinements of block systems and automatic signaling are supposed to take care of the proper location of trains with respect to one another, leaving it to the engineer to look out merely for his own particular signals. But there are cases where the most elaborate systems break down, and where the eternal watchfulness and cool nerve of the man at the throttle are all that stand between a trainload of people and disaster. It is mainly with a view to assisting the engineer in exercising a guardianship over his train which shall not be absolutely dependent upon signals, and so averting those disasters which even now occur on the best regulated roads, that the idea of the vertical-beam headlight was devised. Its greatest value will be shown on roads where the curvature is heavy and the line is located in canyons or runs largely in deep cuttings, or through heavily wooded countries, under any conditions, in short, where the horizontal-beam headlight would be visible for only a limited distance ahead. Then again on single-track roads, where trains are running in opposite directions and meeting, or supposed to meet, only at certain specified stations, the new headlight will have its greatest value. Many a head-on collision has occurred because the trains were running on curves or in hilly country, and were unable to detect each other's presence until the distance between them was too short to avoid disaster. With the vertical beam, of course, an approaching locomotive can be located when it is hidden from direct view by a curve or an intervening hill.

The headlight equipment, which is built by the Edwards Railroad Electric Light Company, consists of four parts: first, the motor, a simple-acting steam turbine; secondly, the dynamo, mounted on the same axle with the turbine and designed to yield to the arc light a current of from 30 to 33 amperes and from 30 to 33 volts; thirdly, the lamp, including the arc, the deflectors and the case; and fourthly, the bedplate on which the whole apparatus is mounted.

The steam turbine is provided with a propeller wheel which is wholly constructed of rolled steel. It has a factor of safety of about 7, for while the normal speed of the engine and dynamo is about 2,000 r. p. m., the wheel will withstand successfully a speed of about 14,000 r. p. m. The speed of the engine is held constant, or practically so, regardless of change of load or initial pressure, by a simple and efficient governor, which is so arranged with relation to the other parts of the engine as to be easily and readily accessible, should occasion demand. The wheel shaft is journaled in ball bearings, and the coefficient of friction is so low that the turbine will operate, running to its full speed, under a pressure so slight that a pointer upon a 180-pound steam gage will not leave its stop, the gage being connected between the governor valve and the nozzle. All the moving parts are incased in a cast-iron housing so designed as to thoroughly protect it from the elements, dust, dirt, etc. The lubrication is automatic and is provided by loose rings feeding the oil to the ball bearings from the oil wells.

The dynamo is of peculiar construction, designed for the particular purpose for which it is used. The field is differentially wound, and the electric circuits so arranged that a burned-out armature is impossible. Should a short circuit occur on any point of the circuit, the current is neutralized, and no matter how long the engine may run or the armature rotate, there will be no production of current whatever until the short circuit is removed. As soon as this is done the dynamo performs its proper functions and operates as usual. The current densities throughout the whole machine are very low, so that a minimum heat effect is produced, regardless of extremes of temperature or other conditions which might affect the resistance of the machine. Low-resistance carbon brushes are used, and many months of constant wear show very little deterioration of these brushes. Very large and long journal bearings are provided, and profuse lubrication is secured through the medium of loose rings dipping into the oil wells. An important feature of the equipment is the arc lamp with its parabolic reflector. It is strongly made, and care has been taken to insure a steady and constant light, free from flicker.

A valuable feature of the equipment is the provision of an auxiliary plane deflector, placed outside the goggle at an angle of 45 deg. and in such a position as to intercept about 40 per cent of the whole volume of light issuing from the parabolic reflector and direct it vertically. This vertical beam forms a constant warning signal. Reaching to a great height, and on cloudy nights striking the clouds, it can be seen for many miles. In fact, upon the Big Four road it has been seen for a distance of 21 miles, and on the Chicago, Milwaukee and St. Paul road it has been seen for a distance exceeding 16 miles. The horizontal beam is very powerful, showing up clearly three-quarters of a mile to a mile, on a clear stright track, ahead of the locomotive bearing it.

Perhaps the only valid objection that was raised to the electric headlight is the fact that upon a double-tracked road there might be some tendency to blinding an approaching engineer. To guard against this contingency the apparatus is provided with a translucent shade, within the goggle, which may be drawn at will by the engineer when he is at the proper distance from an approaching engine. This shade destroys the strong glare of the light, giving the effect of frosted glass. As soon as the approaching train is passed the engineer releases the shade and again gets the full value of the light.

The whole apparatus is generally mounted upon one cast-iron bedplate, and it is the work of only six or ten hours to apply the equipment to the locomotive. All that is necessary is to secure the bedplate at the proper place on the smoke arch by means of brackets bolted thereon, the running of a three-quarter-inch live steam pipe from the cab, and the passing of a one and one-quarter-inch exhaust pipe into the smoke arch.

New Deutsch Airship.

M. Henri Deutsch will soon make an ascent from the Aero Club's grounds at Saint Cloud, Paris, with his new airship, "La Ville de Paris." The outcome of the ascent will be awaited with interest.

Correspondence.

The Use of an Artesian Well for Power.

To the Editor of the Scientific American:

In a recent issue of your valuable publication I notice an article under the heading of "Power from an Artesian Well."

I write this to say that there is in this (Hale) county an artesian well 10 inches in diameter that throws out a volume of water sufficient to run a grist mill, cotton ginnery and cotton press and a sawmill. The well is about 600 feet deep, and was bored fifty years ago by Col. Samuel Pickens on the plantation twelve miles southwest of Greensboro, Ala., known as the "Goodrum Place," now owned by Lee M. Otts, Esq. The water comes up with such force from the well that a silver dollar thrown into its mouth will not sink, but will be thrown out. The gusher has diminished very little in the amount of water furnished during the half century it has been running. To give an idea of the amount of water that is thrown from the well, will state that the trough surrounding it is four feet across, and when the water falls back it comes near filling the trough from side to side.

The mill and ginnery run by the water from this well is situated on a hill-side about a hundred yards away, and the water is carried to it by means of a canal cut in the solid lime rock. Just under the mill house is a well 3 feet across and 40 feet deep. In this well, at a depth of 25 feet, is a turbine wheel and the water from the canal is turned on it when it is desired to run the machinery. A tunnel from the bottom of this 40-foot well has been cut a distance of 100 yards—ranging upward—and empties the waste water from the mill into a branch. Wm. E. W. Yerby.

Greensboro, Ala., September 1, 1902.

How Does the Spider Spin Its Web?

To the Editor of the Scientific American:

I was very much interested in an article that appeared in your paper of August 23 about the mystery of spiders stretching their webs across highways and other long distances.

Every observing country boy has noticed these wonderful feats of the spider in suspending his bridge from one point to another, high in air. My father often told us how he and his father, while crossing a bridge over the Merrimack River in Boscawen, N. H., early one morning, saw a spider's web extending clear across the river from one point direct to another, a distance that must have been at least 250 or 300 feet. The sun was just appearing over the treetops and shone upon the web, so that it was distinctly seen the entire length. They speculated how the spider could have spanned the stream with his web. Certainly the web could not have been strung by the help of the wind, which, nine times out of every ten, blows down the river in this locality. The prevailing winds in New Hampshire are from the northwest; and the river at this point flows from the northwest and runs southeast; the bluffs are quite high on each side, from which it follows that the east or west wind could not have blown strong enough at this point to have carried the web across.

Every open-eyed countryman knows that large spiders can walk on the water, or rather run. I have seen them frequently go so fast on the water that one could hardly see them. I have thrown them into the water many times, where the current was swift, to see how soon they would reach the shore. To anyone not familiar with this insect it would be surprising to see how swiftly it can run over the water.

My grandfather thought that the spider ran across the river, although the current was deep and strong at this point. But my father could not agree to this proposition. He said it would be impossible for a spider to regain the other shore so directly across and then carry his web so high above the water and fasten it to the tree branches on the opposite side without getting the web entangled in the branches in climbing the trees. Neither of them could solve the mystery. I have noticed in attics and barns that spiders spin their webs from one rafter to another at an angle of about 30 or 40 degrees. I have also seen them spinning webs from one branch of a tree to another. They seem to jump from one branch and swing on the web so as to reach the lower branch at sometimes an angle of 40 degrees or less. Webs formed on these angles are frequently seen. The upper cable seems to be the one that holds the web; and below this cable the web is spun. But how a web is thrown directly across a road or river is beyond my comprehension, unless the insect after having crossed the river, attaches the web to some bush, then climbs a tree, and spins down to the web, detaching and carrying it to the higher branches. This the spider can do, I am sure, for I used to like to break the webs in order to observe how carefully the insect would pick up the broken strands, mend them, and then carry the broken ends to their proper places.

Lyman Jackman.

Concord, N. H., September 1, 1902.

Electrical Notes.

A Russian specialist has decided that, contrary to the general opinion, electric light plays less havoc with the eyes than other forms of artificial light. He bases his deductions on the fact that disease and damage to the eye are proportioned to the frequency of the closure of the lids. He found that the lids close in a minute 6.8 times with candle light, 2.8 times with gas light, 2.2 times with sun light and 1.8 times with electric light.

A recent number of the Bulletin of the French Physical Society contains a note on a new "electric valve" for transforming reciprocating currents into direct currents, due to M. Nodon. This "valve" is based on the property, discovered by Buff in 1857, that an aluminium electrode plunged in an electrolyte offers a great resistance to the passage of a current in which it is the anode. The efficiency of M. Nodon's apparatus, as measured by a wattmeter, reaches 75 to 80 per cent.

The General Telegraphic Department of Germany has tested the octuplex system of typographic telegraphy invented by the late Prof. Rowland, of Johns Hopkins University. The government will test the apparatus on all lines between Hamburg and Frankfort. It is claimed that the octuplex system will enable 18,000 words per hour to be sent over a single wire by 20 operators. The system now most widely in use is the Hughes, by which only 2,200 words per hour can be sent.

A correspondent of the Electrical Review has written an earnest appeal for the standardization of the catalogues and other literary matter circulated by the manufacturing and supply concerns of the country. The writer said he was connected with one of the larger electrical companies, and had on file a great many catalogues and bulletins to which he had constant occasion to refer, and the work of keeping this mass of matter together would be greatly facilitated if they were of uniform size. Out of 3,500 catalogues in his care, he said, there were no less than 500 different sizes.

Capt. Chevallier's electric target, which was described some time ago in the columns of the SCIENTIFIC AMERICAN, is meeting with marked success in France. At a recent contest held in Rouen five targets were used. So large was the number of entries at this contest that it was impossible for all the contestants to participate. From the 12th to the 28th of July, 68,072 shells were fired with the French army-gun, model of 1899, caliber 8 millimeters, a test which surely speaks well for the durability and efficiency of the device. The electric target has been installed at Peronne for the purpose of testing French and foreign guns. The device will doubtless meet with no slight success.

It is announced that the speed trials on the Berlin-Zossen railway will be resumed next year, and in the meantime work has been begun on another train especially constructed for the purpose. This train will have a number of remarkable innovations. In the first place, it will be covered entirely with a series of metal plates resembling somewhat the scales of a fish, and these, it is thought, will reduce the matter of wind resistance to a minimum. This was found to be a more serious factor than had been anticipated, and is supposed will prove the keynote of success. Another innovation to be tried will be a conduit running along the top of the train to carry the smoke to the rear.

Owing to the number of accidents that have been caused by the tramcars in Birmingham (England) running down people, the authorities are experimenting with a new type of automatic guard or efficient life protector fitted to the vehicle for the purpose of mitigating fatalities. The designing of an efficient guard for this purpose is not a simple matter, since the government Board of Trade refuses to sanction any guard projecting beyond the front of the steam engine of the car. The automatic guard is simple in construction. There is a hanging gate at the front of the car, and this when struck by an object releases a catch, and a spring forces the life guard proper hard down onto the rails. The gate in front swings loosely to and fro. The slightest touch almost from any object coming into contact with it causes the gate to loosen a catch behind. This catch holds an iron rod which is attached to the second gate or guard, made strong and very broad, and fixed horizontally and projecting in front of the wheels. When this catch is released, the front part of the guard falls dead on the rails. It is kept there by a powerful spring, so that it is impossible for anything to pass underneath it. When the guard has once come down, it has to be placed in position again by a catch which is fixed on the driver's footboard. In the large majority of accidents the person falls in front of the car, and in such cases the simultaneous working of the hanging gate and the guard prevents the victim from passing under the wheels. The guard works automatically with the hanging gate, so that if no obstruction meets this, it does not fail.

Engineering Notes.

An amount of money has been raised sufficient to guarantee the success of the scheme to establish a John Fritz medal, to be awarded yearly to the originators of the most useful scientific and industrial achievement. An effort is being made by the projectors to make this a distinction not second to Bessemer's gold medal awarded by the Iron and Steel Institute. The medal will be awarded by a committee representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. A year's deliberation is necessary before any award shall be made, and the sanction of three-fourths of the committee must be had. The eightieth birthday of John Fritz will be observed in New York on October 31 by a dinner which will be participated in by the leading mechanical and electrical engineers of the country.

A novel steam generator has been devised by Mr. Henry Braby, an Australian inventor, wherein the requisite water tubes are bored lengthwise through flat copper blocks of 3-inch or more thickness, the ends of the holes being connected by semicircular bends so as to form a continuous tube from one side of the block to the other. The blocks are so arranged that the hot gases from the furnace pass around a lower one, beneath a second and around this beneath a similar series of tubes in the cast-iron top of the boiler. The water is fed into the iron tube, where it becomes heated, then it passes successively through the top and bottom series of copper tubes, and enters a receiver as steam under a pressure of 100 pounds or more. It is claimed that, for the same power, this generator occupies only a tenth of the space of a multitubular boiler, and is only one-fourth the weight, while it cannot be exploded, is self-cleaning, and it can be heated to 100 horse power capacity in ten minutes.

Some interesting facts concerning the depth of, and cost of constructing, deep-level tubular railroads in London have been given by the various syndicates, such as the Yerkes and Morgan, interested in the extension of electric rapid transit in the English metropolis, before the Parliamentary committee investigating the schemes. In the case of the Brompton and Piccadilly Circus Railroad, under which, by a link with the Great Northern and Strand Railway, through communication will be obtained from Earls' Court in the southwest, to Finsbury Park in the north of the city, the cost of tunneling, including platforms, lifts, etc., will be $650 per yard at the stations, and $240 per yard for the rest of the line. The average depth of the line is to be 60 feet. In the case of the Charing Cross, Euston, and Hampstead Railroad, the depth of the tube beneath Hampstead Heath will vary from 110 feet to 196 feet. In the construction of the Central London Electric Railroad, the depth of the track below the street level varies from 80 feet to 120 feet. In the construction of these deep-level railroads the pulling up of the streets is forbidden, the constructors having to direct their operations from the sites for the stations. By this means no dislocation of the vehicular traffic of the street is caused.

The British Government is carrying out the first complete geodetic survey of South Africa. According to the recent report issued by the royal astronomer at the Cape, the Geodetic arc of meridian has been carried to the Zambesi. The country near the Zambesi Valley has proved the most difficult for surveying. The observing season is a very short one, as transport from Salisbury cannot begin until the rain ceases in March. In many places grass six feet in height was encountered, and as the natives commenced to burn it in July, the smoke caused a cessation in the work, as it was impossible to carry on the observations under such conditions. In the past season's work progress was most seriously delayed by difficulty in procuring oxen for transport. The original plan was that the reconnaissance and beaconing parties should start some weeks in advance of the observing party, but this became impossible because of the delay in transport equipment. Heavy clearing work and ray-cutting had to be done in some places, and progress in reconnaissance and beaconing could not be made to keep pace with the observing. At the more Northern stations first the wagons and the carts had to be abandoned, and all transport had to be done by native carriers. As the result of these delays, two, perhaps three, of the stations south of the Zambesi, yet require to be occupied with the goedetic theodolite. In the interval between the work of the last two seasons the wires used in measuring the base near Salisbury were recompared at the Royal Observatory, the measurement of the angles from the Salisbury base to the main triangulations was completed and signals were exchanged for longitude of Salisbury. The operations northward from the Zambesi will involve an entirely new departure. Observers and supplies will be landed at Chinde and carried up the Zambesi beyond Zumbo, when transport by native carriers will be organized.

Automobile News.

The programme has been announced for the next international automobile and cycle show, which will be held at Paris under the auspices of the Automobile Club in the Grand Palais, from the 10th to the 25th of December next. This will be the fifth exposition of the kind, and will no doubt be as great a success as last year's show. The exhibits have been divided into sixteen classes, of which the first includes automobiles of all kinds, motor-cycles and all vehicles using mechanical traction. Only the constructors are allowed to exhibit in this class, but exceptions are made in favor of foreign exhibits. A special category is made for the heavy-weight vehicles, tractors, etc. The second class includes cycles, and the third, material of construction and tools for the manufacture of automobiles and cycles. Next come the tires, trucks and mechanical parts, detached pieces, motors, etc. Automobile boats and airships are also provided for, and a special effort will be made, as last year, to bring out the practical applications of alcohol. As to the customs regulations, the commission is to take the necessary steps to have the exposition made a place of deposit, if possible, so that products can be entered free of duty on condition that they are exported afterward. Demands for space should be addressed to the Commissariat General de l'Exposition, 6 Place de la Concorde, before the 10th of October next, where copies of the rules can be also obtained on request.

Now that the Gordon-Bennett cup has passed from France to England, the British Club is making an effort to have the next international race held in that country, as heretofore it has always taken place in France. To do this, however, permission must be obtained from the authorities, and this may not be an easy matter. A member of Parliament, the Hon. Scott Montagu, a prominent chauffeur, has introduced a bill which will rank automobiles on the same footing as other vehicles as to travel over the routes. If the bill is passed, the next step is to obtain the permission of the local authorities. Supposing that the race is finally organized, it will probably be held from 2 to 8 o'clock in the morning so as not to interfere with the traffic, and during two days. There are several different routes which might be chosen. That of London to Edinburgh covers 400 miles, but has a considerable traffic, even during the night, which makes it undesirable. The route from Preston to Glasgow, through the North, would be preferable, as the roads are fairly good and the population is not very dense. Another route is in the region of Kendal and would pass by the Cumbrian Mountains, climbing a 10 per cent grade from Penrith to Carlisle; from here starts a fine route of 100 miles leading to Glasgow; from there the racers would cover 50 miles to Edinburgh and would then proceed to Newcastle or Sunderland.

The Current Supplement.

The interesting article begun in the last issue of the SUPPLEMENT on the Krupp exhibit at the Düsseldorf Exhibition is concluded. This last installment is illustrated just as fully as the first. Mr. Edward R. Taylor describes tersely his method of making bisulphide of carbon in the electrical furnace. The method is of rare interest to the electro-chemist. Dr. F. A. C. Perrine discourses very fully on long-distance power transmission, a subject on which he is a recognized authority. The Northrop loom, one of the most ingenious pieces of textile-making machinery ever invented, is described by Mr. Irving U. Townsend. A new method of carving by machinery is described. The recent death of Prof. Rudolf Virchow, the most famous of modern pathologists, renders a biography and an account of his life-work of great importance. "The Relation of the Psychic Life to the Nervous System" is the title of a lecture recently delivered by Prof. E. G. Conklin, of the University of Pennsylvania, before the Philadelphia Society of Ethical Culture. The paper will doubtless interest our psychological readers. The Consular Notes, Trade Notes and Selected Formulæ will be found in their usual places.

Another Pelee Eruption.

Again the terrible Mont Pelée of Martinique has wrought havoc in the stricken island. In an eruption which almost paralleled that of last May, spreading some five miles farther eastward, over two thousand persons lost their lives. After the catastrophe of last May most of the inhabitants fled, but those who remained were removed by the officials. Assuming that the vicinity of the volcano was safe, the people were transported back two weeks ago to their homes. Then came this last blow. Warships and steamers are taking the people from the coast towns and villages, whither the inhabitants from inland places have fled. It is said that the eruption was one of the most violent yet experienced. Detonations were heard as far as the island of St. Kitts. La Soufrière erupted almost simultaneously with Mont Pelée.

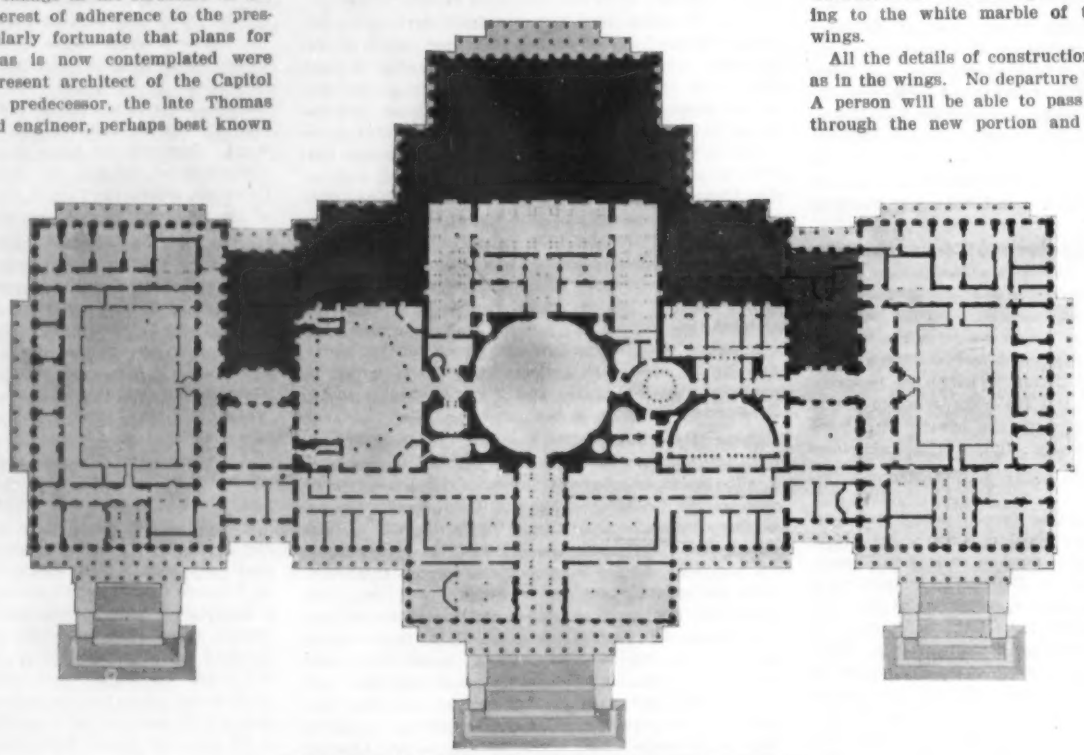
THE ENLARGEMENT OF THE UNITED STATES CAPITOL.

BY WALDON FAWCETT.

The Capitol at Washington, famous as one of the most notable architectural masterpieces in the world, will, in the near future, receive the most extensive addition which has ever been made to it. This statement is especially significant from the fact that the entire history of the building has comprised a series of additions to a nucleus of rather meager proportions. The present project dates from the spring of 1901, when the architect of the Capitol was directed by act of Congress to prepare plans for the extension of the central portion of the Capitol, for the renovation and decoration of the Rotunda and for the erection on ground adjacent to the Capitol of a fireproof building for office, storage and power-plant purposes.

Presumably no architect would have the temerity to suggest any radical change in the structure of the Capitol; but in the interest of adherence to the present style, it is particularly fortunate that plans for an enlargement such as is now contemplated were handed down to the present architect of the Capitol from his distinguished predecessor, the late Thomas U. Walter, architect and engineer, perhaps best known to fame as the creator of the great white dome of the Capitol and the marble wings now occupied by the Senate and House of Representatives, respectively. Not only was the enlargement of the Capitol provided for in the plans prepared years ago, but the extension soon to be undertaken will in reality but carry out the original conception of an enlarged Capitol as evolved by Architect Walter at the time he planned the Senate and House wings and capped the structure with its stately dome. Moreover, the new portion, instead of appearing incongruous or out of harmony with the present pile, will actually add to the majesty of the ensemble effect.

The old Capitol building, fostered by George Washington and designed by Thornton, was considered to afford, when completed in 1830, ample accommodations for the then existing and probable future needs of the country. However, the tremendous progress of the nation soon rendered imperative the provision of more space. Then came the first extensions begun in 1851 and completed in 1859. Congress authorized and Architect Walter carried out the construction of the marble additions at the north and south. In this, as in all his work in connection with the Capitol, the architect adhered faithfully to the spirit of the original; and realizing at the same time, that the future might again find the Capitol inadequate in accommodations, he devoted much time to the preparation of plans for an extension to the eastward of the present building—an addition which would harmonize with what already existed, and also give additional beauty to the splendid dome which he designed and erected and which he hoped would one day grace a completed structure. The most eminent architects have agreed that in meeting present exigencies it would be unwise to alter the original plan in any particular as concerns the exterior proportions and alignments. The construction of the addition contemplated will cost approximately $2,500,000, and while it involves the removal of the old portico at the east, it does not involve the removal of the principal walls of the old and historical portion of the Capitol. The present front wall of the old building remains as the rear wall of an open court, which lights the west side of the proposed addition. It is difficult for even the persons thoroughly familiar with the building to appreciate what an enormous addition will be made to the capacity of the structure by this new construction. The area will be increased in the aggregate from 132,730 square feet to 184,120 square feet, an increase of 51,390 square feet, or 38 per cent. Otherwise expressed, the increase of the capacity of the building amounts to 1,854,400 cubic feet, of which amount 1,068,000 cubic feet are provided in the new east front, or in other words, the addition to be built eastward from the central portion of the building as at present constituted. To the reader dependent upon recollections of the appearance of the Capitol, or even upon consulting a picture of the building as it at present appears, it may seem well-nigh incredible that there is available space for such an addition as is proposed with so slight a departure from the present perspective. As a matter of fact, however, the central flight of marble steps on the east front, leading to the portico of the rotunda, is indented twenty feet within the line of the two marble wings. Not only will all the space of this indentation be occupied by the addition, but it will project about fifteen feet beyond the line of the wings, thus eliminating all suggestion of a rambling appearance in the building considered as a whole, as well as any suspicion of the undue size of the dome. In the interest of the maintenance of absolute harmony, the extended front will be faced with a magnificent portico of fluted Corinthian columns, so elaborate and superior in general contour and size as to unmistakably dominate the porticoes of the wings. In short, the new construction will not only convey an impression of greater depth and compactness in the entire building, but will also provide a larger, broader and consequently more imposing base for the massive dome.



PLAN OF THE CAPITOL AND OF THE PROPOSED EXTENSION.

DESIGN FOR THE ENLARGEMENT OF THE UNITED STATES CAPITOL AT WASHINGTON.

Admirers of the Capitol should welcome the planned enlargement by reason of the fact that it will give opportunity for a much-to-be-desired uniformity of construction throughout the entire noble edifice. For years past it has been a matter of regret that the material comprising the older portion of the building was not marble, but scaly sandstone, which has required constant repainting in order to preserve its appearance. An opportunity is now afforded, however, to displace or cover over this unsatisfactory material, thereby restoring uniformity to the exterior of the building, and accordingly it has been determined that the facings of the extensions on both the east and west sides of the building shall be of marble, conforming to the white marble of the Senate and House wings.

All the details of construction will also be the same as in the wings. No departure from this will be made. A person will be able to pass from either wing and through the new portion and see the same general structural and ornamental features. The magnificent entering vestibule, 108 feet in length, will be but an enlarged example of those at the east doors of the Senate and House respectively. The rooms will appear in interior form like those in the wings, and will be commodious and large, approximating 22 by 30 to 32 feet in dimensions. The interior arrangement, it may be noted, does not conform to that outlined by Architect Walter. The requirements of the times have necessitated some departures from his proposals. The splendid marble corridor leading to the Rotunda, which was his conception, has been retained, but the rooms on either side of it have been rearranged. Under the modified plan it has been found possible to provide a total of sixty-six rooms — thirty-three apartments for the use of the Senate and a like number for the House of Representatives.

The improvement of the rotunda presents some exceptional difficulties. The leading artists and architects of the country have been called in consultation, and the conclusion reached that two things are possible—either that it may be simply redecorated as it is, or all the work below the cornice may be remodeled. Which plan will be adopted has not yet been definitely determined, although it is probable that there will be an adoption of the proposal advanced by Architect Walter for increasing the appearance of strength of the present pilasters by the addition of outer columns and a modified cornice above. The additional proposal, which is likely of acceptance, contemplates the addition of a casing of marble, suitably disposed as to color, the carrying of the same to the cornice and the reconstruction of the latter in marble. Furthermore, it is planned to reframe and somewhat elevate the immense historical paintings which now ornament the Rotunda, and form one of the features of popular interest in the Capitol. The approximate cost of this portion of the work will be $275,000.

QUEER CRAFT SEEN ON MY TRAVELS IN THE PHILIPPINES, CHINA AND SOUTH AMERICA.

BY E. C. HOST.

Our first view of Manila as we steam on a small launch up the Pasig River to the landing stage discloses a panoramic assortment of shipping not equaled for strange and interesting features anywhere. At times this narrow river with its always rapid current is so completely jammed or choked with shipping that navigation is attended with great danger.

BALSA (BOAT BUILT OF GRASS) ON LAKE TITICACA (PERU AND BOLIVIA.)

Here we find the huge, heavy casgoes in which merchandise and freight of all descriptions are transported from the large steamer anchored in the bay to the wharf. These casgoes are of wood, about the size of an American canalboat, and are covered with a bamboo roof, easily removed in sections. Over the after part of the boat the roof is considerably raised, thus forming a roomy cabin wherein live the navigator and family. It was in these boats that most of our troops were taken ashore from the army transports.

Within a few blocks from the Captain of the Ports' office at the landing stage we come to the Binondo Canal, on our way to the central or old port of Manila. On this canal are used very curious ferryboats. They

OUTRIGGER AND SAIL FERRYBOAT AT ILO-ILO, PHILIPPINES.

are small, built of heavy timbers covered with a wooden flooring, over which is erected a skeleton framework of wood, in turn covered with a bamboo roof. Each boat carries about fifteen passengers and is impelled by means of a long pole dexterously handled by the native "fletero."

The change in management in reference to these ferryboats offered proof that the native is very susceptible to, and capable of, conforming to American customs, which he imitates promptly. For years it had been the custom to have a small tin can fastened directly under the roof of these boats; into this the

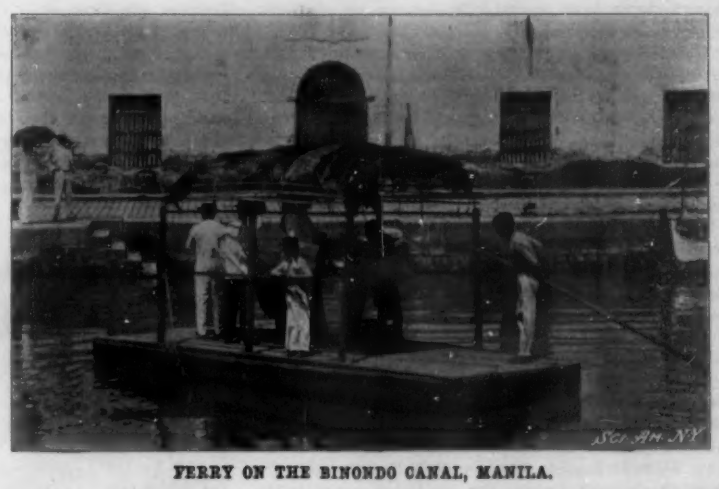
passenger dropped a copper coin. Shortly after the arrival of the troops the discovery was made that certain persons, instead of dropping a copper coin into the can, would drop a small stone or nail, etc. It was the introduction of this latter custom which at once caused the native boatmen to adopt the American method of collecting fares. In the river here we see many canoes or dugouts passing back and forth; these are made by the natives from solid logs, which are dug out, and they are impelled with a paddle. It is interesting to watch the natives pass up or down, with or against the swift current, in these small craft laden with all sorts of goods, produce, vegetables, fruits, grass for fodder, etc.

I had the good fortune to travel south from Manila with Gen. Bateson on his memorable trip when he made the now famous bloodless treaty with the Sultan of Jolo, who controls one and one-half millions of people, who are perhaps the craftiest of all Filipinos. Our first stopping-place was at Iloilo, island of Panay, which place had been burned by the natives. The island is famous as being the greatest sugar-exporting center in the archipelago. Here are used the double outrigger ferryboats which are one of the strangest sights in our far-off possessions. These boats are made of huge logs also dug out or burnt out. They are fitted with masts and carry from two to four sails. On either side is a bamboo outrigger which distinguishes them from outrigger boats in other parts of the Pacific, where only one outrigger is used. Bamboo being hollow, intersected by many partitions running crosswise, is practically a tube of many airtight compartments; and as the bamboo grows to an extremely large size, up to eighteen inches in diameter, these long airtight tubes are capable of sustaining great weight above water. In some instances on large boats, the bamboo is tied in bundles on either side of the boat, which are suspended from cross beams and rest on the water. It is almost impossible to capsize one of these boats, which attain remarkable speed. With the same sail area they will outsail any boats in our home waters. They should form an interesting study for yachtsmen. These boats would circle quite around our steamer, the "Churraca," an ex-Spanish transport, in a moderate breeze, while we were steaming at ten knots per hour. A landing is effected by running the boats onto the sandy beach, when the passenger steps ashore.

Our next port of call was Jolo, capital of the Jolo or Sulu group, where the negotiations which culminated in the signing of the treaty between the United States and the Sultan of Jolo were carried on. At this place we also find the double outrigger used on all native boats, be they the small dugout for one or two persons, or the huge war canoes of the Sultan, capable of carrying from fifty to eighty people. These boats here are more picturesque, being of more attractive shapes and elaborately ornamented with beautiful carving.

These outrigger boats are also used by the natives in their pearl fisheries, which industry is next to hemp of greatest importance in the southern islands. The Sultan's people, the Moros, are expert navigators and are known to the world as a dangerous tribe; for until very recently these islands were marked on the charts with the warning sign of "Pirates." The Moro travels in his outrigger boat many miles from island to island; his boat and paddle are his most valued possession, not even excepting his wife, who is practically a slave to him.

Across the China Sea from Manila, a distance of some seven hundred miles, we find not only interesting craft of all kinds, but that the native boats are navigated in nearly every instance by women, who act as pilots for large vessels that enter the beautiful harbor of Hong Kong. It is not unusual to see a woman at the tiller wearing a huge umbrella-shaped hat and having fastened on her back a child.



FERRY ON THE BINONDO CANAL, MANILA.

These native boats are constructed of wood and bamboo, are fitted with a mast and carry a set of sails, and are used to carry produce and merchandise from place to place. The native family lives on these small boats, in fact they spend their entire time on the water. For a rudder a very long oar is used and handled in an expert manner by the woman navigator.

The strangest craft I have ever seen on all of my travels were the balsas of Lake Titicaca in Bolivia and Peru. These balsas are made of grass, an aquatic plant, growing in the waters of the lake. The principle on which they are constructed by the Aymaras Indians proves their ingenuity. A bale of hay naturally floats in the water, and according to the quantity of dried grass used in constructing the boat do they control the displacement or carrying capacity. These boats are likewise fitted with a mast and sail, and in some instances carry from eight to ten persons. The Indians travel long distances over this vast inland lake, the surface of which is on a level with the summit of the Jung Frau of the Swiss Alps.

DUGOUT CANOE, WITH BAMBOO OUTRIGGER. USED BY MOROS, SOUTHERN PHILIPPINES.

CHINESE PILOT BOATS AT HONG KONG, NAVIGATED BY WOMEN. (NOTE THE CHILD ON THE BACK OF ONE WOMAN.)

Diamonds in Guiana.

Prof. J. B. Harrison, Government Geologist at Georgetown, states that diamonds have been found in three districts of British Guiana—in the north on the upper waters of the Barima River, on the Barima River about Ianna, some 60 miles to the southeast, and in the Upper Mazaruni basin, in a district which, so far as geological indications go, may extend over the tract of country between the head-waters of the Mazaruni and Peruni rivers, though up to now all discoveries have been made about the basin of the Putareng River. There is also the Omai district on the Potaro, a tributary of the Essequibo River, which lies in a southerly direction from Georgetown. This wide diffusion of the gem shows that the chances of enlarging the area in which it may be mined are favorable. The diggings at present are confined to the Putareng and Potaro districts. There are a dozen companies either mining or prospecting in the first named district and others are being formed.

Another Ziegler Expedition.

William Ziegler has sent the relief ship "Frithjof" with a party of explorers to the North Pole. The expedition is entirely distinct from that commanded by Baldwin. Who is commanding the second Ziegler party has not been divulged.

ADJUSTABLE WHEELBARROW.

The wheelbarrow which is shown in the accompanying illustration is so constructed that it may be readily adjusted to fit or hold articles of varying sizes. The handles are adapted to be moved toward or from each other, but when released they will be automatically thrown outward, or separated, under tension of a pair of spring straps.

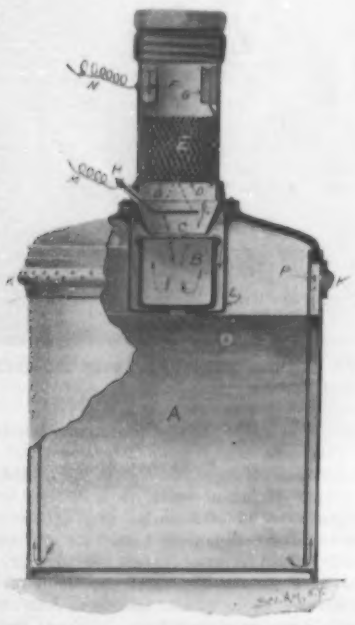
The engraving shows the wheelbarrow handles, *A*, partly drawn together. The handles are preferably made of wood faced with iron strips, *E*. At their forward ends the handles are pivoted between two yoke-pieces, *D*. These yoke-pieces are connected together by bolts which pass through sleeves, the latter serving to properly space the yoke-pieces apart, and prevent binding on the handles. Pivot bolts pass through the yoke pieces and the handles, and at their lower ends are provided with eyes which form bearings for the axle of the wheel, *B*. The spring-yielding straps, *C*, extend forward from the handles and are joined together at their forward ends. Stop pins, *F*, are located on the handles at suitable places to prevent a barrel or other article from rolling or sliding against the wheel. These pins extend in both directions, as shown, for the wheelbarrow is designed to be turned either side up, since by turning it in the reverse position to that illustrated, the handles will be brought closer the ground, making the loading of heavy boxes or barrels much easier. The wheelbarrow can be made at a comparatively small cost, and when not in use it may be folded closely together, and therefore will require but little space for storage as it can be stood up in a corner. A patent for this invention has recently been granted to Messrs. W. A. House and W. F. Hosken, of Covington, Ky.

ADJUSTABLE WHEELBARROW.

AUTOMATIC CHEMICAL FIRE EXTINGUISHER.

A very novel automatic fire extinguisher has recently been invented by Mr. Louis Werlün, of Elsmere, Del. The device belongs more particularly to that type in which a liquid is precipitated from one receptacle into another for the purpose of generating a gas fatal to combustion.

Our illustration shows the extinguisher partly broken away to bring out the details. The flask or outer containing vessel is provided with an inner concentric cylinder, which is detachably secured to the dome-shaped cover of the extinguisher. A perforated annular member, *K*, having substantially the form of a semi-tube encircles the upper ends of the flask. Between this annular member and the flask is a thin membrane, preferably tinfoil, which covers a circle of openings, *P*, in the wall of the flask. Suspended from the cover piece is a cup, *B*, normally filled with an acid. A thin disk of tinfoil, *C*, covers the top of this cup and prevents evaporation of the liquid. A funnel is fitted gas-tight into the mouth of the cover piece directly over this cup. The metal strip, *H*, extending



AUTOMATIC CHEMICAL FIRE EXTINGUISHER.

into this funnel is connected with one pole of an electric alarm, while the metallic neck of the flask is connected to the opposite pole. Upon either side of the neck are disposed the rods, *F*, slightly hooked at their lower ends to tentatively uphold two gates, *D*, on which a quantity of shot, *E*, is supported. In the neck are the receptacles, *G*, containing wax or any other readily fusible substance, in which the rods, *F*, are embedded. So long as the wax does not melt, the gates will be supported. When, however, the heat is great enough to melt the wax, the rods drop slightly, releasing the gates, *D*, which thereupon fall into the dotted position shown, complete the electric circuit, and ring the alarm bell. The shot at the same time is precipitated onto the tinfoil disk, *C*. This is easily ruptured, and the shot fills up the cup, *B*. The acid thereupon flows over into the alkali, which fills the body of the flask, *A*. Chemical action immediately takes place, and a gas is generated. Finding no escape through the neck of the bottle, the gas forces the liquid in the inner cylinder downward, and causes the liquid in the annular space between the outer and inner cylinders to rise. The pressure is sufficient to rupture the tinfoil covering of the perforations, *P*, and the liquid is sprayed out, thus extinguishing the fire. If the inner cylinder be removed, no raising of the liquid takes place, but the gas itself passes out of the perforations, when sufficient pressure has been attained, and chokes out the fire. The extinguisher may be located in the room which is to be protected at a point near the ceiling, where it will be comparatively inaccessible. Now, if a fire breaks out, the heat generated will cause the alarm to be automatically rung and the liquid sprayed out or a gas formed, which will extinguish the fire.

Baldwin's Failure.

Mr. Evelyn B. Baldwin has explained his failure to reach the Pole as follows:

"Tromso, Norway, Thursday.—The public has been deceived by false reports regarding the expedition. Nearly every member has been faithful, and my comrades ought to and must have due credit for their work in establishing large depots at Camp Ziegler during March, April and May. Sometimes they had to traverse the same route ten times. Fifty sleighs were destroyed in this work. Open sea near the depot at Teplitz Bay prevented us from reaching the Duke of Abruzzi's headquarters, and poor ice conditions in 1901 prevented us from establishing depots north of 80 deg. 22 min. In this connection the death of half of our dogs necessitated the postponement of going to the Pole. Nothing favored returning by way of Greenland.

"I believe the record of being the 'farthest north' could have been broken, but it would have exhausted our supplies and destroyed the hope of finally reaching the Pole.

"Sailing Master Johannssen's demands to become the 'America's' captain were untenable and unbearable. His threat December 15 to take possession of the ship as captain, and deal with the crew in accordance with his own will, might have spoiled the expedition's plan if enforced. The ice pilot, as well as the first mate, who had long experience in polar ice, were entitled to recognition. Johannssen's refusal to obey the ice pilot's orders, and his declared unwillingness to take the advice of my representatives on the sleigh expedition, together with other well-founded reasons stated to the American consul now here, caused his discharge and the promotion of three of his countrymen, who all followed me in the sleigh expedition and obeyed with pleasure the orders given by myself, my representatives and the ice pilot.

"(Signed) BALDWIN."

Moving Vans for Transoceanic Use.

Vans for moving household furniture from one city to another are much more common in Germany and other parts of Europe than in the United States. These vans, which are owned by companies with agents in different cities, are loaded with furniture and other household goods at residences, hauled on trucks to the railroad, and loaded on flat cars for their destination. Here, they are received by the company's local agents and are unloaded at the house where the furniture is to go. When possible, the van is reloaded in the same vicinity and sent back to the place of starting. Thus, one may see in Italy or France furniture vans from Berlin or Dresden.

The saving in packing, the avoidance of extra drayage, and of the danger of breakage have made the system popular, especially in Germany. The vans in use there vary somewhat in size, many of them being almost as large as an American box car.

Recently, efforts have been made to extend the system so as to provide for the shipment of household goods across the ocean. A New York storage and van company has established connections in various parts of Europe and proposes to send vans abroad when satisfactory arrangements can be made. If a man living in New York, for example, wishes to remove to a city of Germany, he will be furnished with one or more vans, in which his household goods are placed. The van is transferred to the ship, and, on landing at the foreign port, is again transferred to the car or river boat and carried to its destination.

The agent of the New York company, who recently made a tour of the Continent, claims that in the short trial made, the use of the vans has proved highly satisfactory, both in cost and convenience.

The vans employed by this company are 16 feet long by 8 feet wide and about 6 feet high. They are solidly built of wood, specially selected for protection against dampness, and are covered with thin sheet steel. They are readily conveyed onto and from ships and railway cars by the usual hoisting apparatus.

As a new phase of international commerce the matter will be watched with interest.

M. Perrier has patented a special apparatus for obtaining by means of petroleum, of the weight of 650 grammes per liter, a gas of an illuminating power much superior to that of coal gas. This apparatus consists of a bellows of plaited leather, whose design is to cause the air to pass between into the three saturators, each provided with a level; and in order to keep account of the quantity of petroleum which they contain, they have on the inside different plates for shifting. The air arriving by the pressure produced by the bellows traverses the first saturator, then the second, and finally the third, and then passes into a gasometer. By this means 2,600 liters of gas, or 2½ cubic meters per liter of petroleum should be obtained. We would suggest that petroleum of the weight of 650 grammes a liter is not really petroleum, but gasoline. We think the weight should rend 850 grammes.

A SHUTTER ATTACHMENT.

A simple little device which will be found very useful in any house has been invented by Mr. G. J. Eppright, of Manor, Travis County, Tex. The device comprises a small spacer which may be inserted at will between the slats of a shutter to hold them open to the wind. Shutters as ordinarily made may be secured in two positions: The closed position, in which the slats are inclined at such an angle as to overlap each other and to exclude both light and air, or the opposite open position, in which the slats permit the light to pass downward diagonally into the room but interfere with the passage of a breeze. These two positions do not fulfil all requirements, for there are often times when one desires to exclude the sunlight without obstructing the circulation of the air. This may be done by the employment of Mr. Eppright's device, whereby the slats are locked in horizontal position so that the sunlight is practically excluded while no obstruction is offered to the air currents.

As clearly indicated in our illustration, the spacer consists of a wire bent to an approximate U-shape;

SHUTTER ATTACHMENT.

this spacer is pivotally mounted on the slat bar through the medium of a sleeve. When not in use the spacer may be swung out of engagement with the slats. It is evident that but a single spacer is required for each shutter, since the slats are all connected with the same slat bar, and the whole series will be held in horizontal position if any one of the slats is so secured.

The "Kaiser Wilhelm's" New Record.

On her last trip to New York, the "Kaiser Wilhelm der Grosse" broke her western record, making the trip in 5 days 15 hours and 20 minutes. The vessel has beaten that time on her eastern trip.

Hydraulic Mining at Nome.

BY WILLIAM H. HALE, PH.D.

The primitive, haphazard methods of mining for gold by hand near Nome, Alaska, are rapidly giving way to improved and systematic work, and notably to hydraulicking.

It was my good fortune to be present at the installation and preliminary tests of the great pumping plant just completed by Charles D. Lane, which is one of the largest works of that kind in the world, and especially remarkable because all the ponderous machinery had to be landed across the surf in lighters. Not a piece was missing, however, when they were all collected and put together.

These preliminary tests were made in the presence of a few invited guests on July 30, and the works are now in regular operation, forcing water to the height of 764 feet, and giving a constant supply of 250 miner's inches. The intake is from Snake River, near its mouth; also some pure water is received from drainage of the tundra, the water of Snake River being very muddy. It is forced through a strong steel pipe 18 inches in diameter nearly to the summit of Anvil Mountain, and thence distributed to numerous places, and used to wash out the gold.

The pumping building rests on a bed of concrete, which is built upon a foundation of ice and frozen gravel. In order to prevent heat from the fires and machinery from thawing the ice and thus unsettling the building, air passages are constructed through the concrete, ventilating it thoroughly. This is doubtless the only great structure ever erected on such a foundation.

The cost of building, machinery and pipe is about $350,000, and it is believed that it will more than pay for itself every year.

Encouraged by the success of this enterprise, Mr. J. W. Kelly and the Pioneer Mining Company are about to build a plant to pump water through four pipes, of the diameter of 6 inches each, from Nome River to the summit of King Mountain, which lies a little to the rear of Anvil Mountain and is also somewhat higher. Crude petroleum will be used as fuel.

The Miocene Ditch, so named from the geological formation which it traverses, is another enterprise which takes water by gravity, without pumping, from Hobson, Banner and Glacier creeks. The entire length of this ditch will be twenty-four miles. It was commenced last year, and in its unfinished state it is already furnishing water to wash the rich gravel of Snow Gulch. A tunnel of 1,900 feet will next year pierce the mountain which divides this gulch from Anvil Creek, and will supply many rich claims with power. It has been found that the tundra, mixed with shale or pebbles, makes an ideal bed and walls for the aqueduct, being both strong and impermeable. It is also very cheap to build, because the materials are everywhere at hand.

Many minor hydraulic enterprises indicate that this system will be in general use throughout much of the Seward Peninsula by 1903, resulting in large production of gold at comparatively little expense.

The rapid adoption of hydraulic systems is illustrated by the beginning of work on a canal to be fifteen miles long, and to bring water from Nome River to points along the left bank, which will require a year to complete. The property comprises sixty-four claims along Nome River, which take in also the river bed. At one point is a large bend in the river, and between points of the bend is a low divide, evidently the old channel. This will be washed out and the gold extracted, forming a new channel, or rather the restoration of the old one; then the entire bed of the present bend will be washed for gold.

Pupin's Latest Invention.

As the result of the continuation of his investigations of the propagation of electric waves along conductors, Prof. Pupin has taken out two more patents on a system of multiple telegraphy based on resonance. It is the object of the invention to send a number of messages simultaneously over a single conductor by means of currents of different periodicities. Given a periodic electromotive force acting upon a conductor of adjustable capacity, self-induction and resistance, it is possible, by varying the capacity or self-induction, so to proportion these electro-magnetic constants to each other that the natural period of the conductor is made equal to the period of the electromotive force. When this occurs the conductor and the electromotive force are in electrical resonance. A resonant conductor offers less resistance to the electromotive force with which it is in resonance than to any other, from which it follows that a resonant conductor can serve as a current selecter. If the conductor forms part of a system comprising a number of electromotive forces of various periodicities its resistance will be less to that electromotive force with which it is in resonance. In a system of conductors having adjustable self-induction coils and condensers, the coils and condensers can be so adjusted that each conductor will have a different predetermined natural period, and, therefore, each part will resound to a periodic electromotive force of its own pitch independently of the presence of other electromotive forces. Such a system will, therefore, act as a set of current selecters, and this forms the essential feature of the invention of Prof. Pupin. The system described by Dr. Pupin in his patents has no moving synchronous parts. It is applicable either to selective single or to multiplex telegraphy.

BORING CLAMS OF THE NORTHWEST COAST.

BY JAMES G. M'CURDY.

One of the strangest mollusks known to science is the Piddock, or "Boring clam," belonging to the family of Pholes. The members of this curious family bore

PIDDOCKS IN THEIR ROCK-DWELLING

into the sandstone ledges skirting the sea, and there take up a permanent abode, where they can be found embedded at varying depths in the rock.

Belonging to a family that is scattered world-wide, Piddocks have received considerable attention at the hands of naturalists from the earliest times. But inhabiting as they do only those portions of the ledges that are never laid bare save at extreme low tide, their movements are so screened from man's prying eye that to this day they remain somewhat of an enigma.

Many old ruins along the sea, as well as the rocky coast itself, bear traces of this indefatigable miner of the lower world. The marble columns of the ancient temple of Jupiter Serapis, standing upon the shores of the Mediterranean Sea, are said to be chiseled deep by the Piddocks of by-gone days.

"How do they get into the rock?" is a question invariably asked by those who for the first time see the Piddocks in their peculiar habitations. Authorities have been greatly divided upon the subject. Some have held that the creatures secreted an acid that

DIGGING OUT BORING CLAMS.

ate the rock, while others have declared that it was by long-continued action of the tongue that the burrows were excavated.

Both of these theories can be safely discarded, as it is now universally believed that the clam bores into the rock by aid of its sharp shell, which is replaced by secretions as fast as it is worn away. The muscular foot, which can be thrust forth at will in the working form, being clamped to the rock, forms a fulcrum about which the sharp shell can be brought to bear in any direction. Raspings on the walls of the burrow show conclusively that the shell is used in drilling.

Several species of Piddocks are found on the shores of Puget Sound, some inhabiting the hard clay banks bordering on the sea, while others select exclusively the sandstone ledges as places of abode. Those living in the clay banks are larger and tougher than the rock-dwellers. The latter are usually about three inches long, and are as a rule buried about six inches in the ledge. I have found specimens over four inches long, embedded fully eight inches deep.

They are roughly oblong in shape, the inner end being large and rounded, while the outer end is flattened and terminates in a long tongue or siphon. The siphon lies in the small, tube-like passage which affords the Piddock its only means of communication with the outside world, and is usually thrust out to the surface ready to extract the animalcules from the sea-water, upon which the clam feeds. At the first approach of danger, the siphon is withdrawn and the burrow closed to intruders by means of the long, leathery continuations of the shell.

The shell of the mollusk is thin and brittle. The flesh is very tender and palatable, and along the Oregon coast, where the Piddock is plentiful, "Rock Oyster Soup," as it is called, is considered a great delicacy.

That the creature does its boring while small is evidenced by the burrow, which is rarely over one-quarter of an inch in diameter at the surface of the rock. The passage-way increases in size at a uniform rate, and contains no lateral indentations, showing that the Piddock had not stopped for any length of time at any given spot, while continuing its boring operations.

When the desired depth is attained, the clam ceases from its labors, excepting to enlarge the cavity in which it lies, as its growth necessitates. After discontinuing its boring, its muscular foot is gradually absorbed and the orifice through which it formerly protruded closes up.

As far as the writer can ascertain, no one has been able to watch a Piddock actually at work. All the forms described by naturalists were at rest, having the foot more or less absorbed. The writer in his investigations has been no more fortunate than others, as all his endeavors to secure a working form ended in failure.

Like other marine borers, Piddocks show remarkable engineering skill. If a portion of rock be broken off, it may be found honey-combed by burrows dug by the enterprising creatures, yet no passage will be found breaking into that of another.

As may be surmised, digging out boring clams from the rocky ledges in which they lie domiciled is no easy task. On the Oregon coast, when the demand from the neighboring sea-side resorts warrants, portions of the ledges are loosened with dynamite, and the clams secured with but little additional effort. But elsewhere, a pick and crow-bar are the implements commonly used.

Being desirous of obtaining some specimens to photograph, the writer made a visit to the Piddock bed lying at the head of Port Townsend Bay, during the low summer tides. In spite of his care, every clam secured from the ledge had the shell broken or was otherwise mutilated.

He was about to give up the quest, when he noticed a fragment of rock lying close by which had been detached from the ledge some time before. A blow with the crow-bar shattered the rock and in the fragments a number of the coveted Piddocks were found intact. These were photographed in their original rock-dwelling, while still alive.

Geologically considered, these mollusks are of considerable importance, as they undermine and gradually break down rock shores and reefs. Breakwaters and harbor works have also suffered from their incursions.

Sails for the Seven-Masted Schooner.

The recently launched seven-masted schooner "Thomas H. Lawson" will probably receive the most remarkable canvas equipment ever prepared. Eighty-three thousand square feet of duck will be used. Of this quantity, 43,000 square feet will be employed for the twenty-five sails of the vessel, while the rest will be utilized for sail covers and awnings. Three tons of pure manila beltrope made from special stock have been used in making the ropes. When it is considered that the sails will be subjected to an enormous strain, it becomes evident that special precautions were taken in designing particularly strong fastening devices. The thimbles are retained in place by wire cringles instead of sewn tar rope. The clew rings are said to be unusually large and heavy. Eight thicknesses of heavy duck were put into the clew patches at the corners of the sails.

Over fifty species of fish never before known to scientists were discovered by the United States Fish Commission steamer in the Hawaiian waters. Most of the specimens were hauled from depths to which the light of the sun can never penetrate. Still the fish were equipped with eyes, from which the scientists of the party inferred that they saw by phosphorescence. At a depth of 1,500 fathoms a rare specimen only four inches long was captured.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

ATTACHMENT FOR PLANTERS.—M. JOHNSON, Coleman, Texas. The invention comprehends a novel construction of attachment whereby the sweep can be conveniently adjusted for either smooth or rough ground. The construction is also applicable for use on what is known as a "middle burster" and other carriages of similar construction. The machine, therefore, comprises several useful implements in one, thereby making it more economical to utilise a planter equipped with this attachment than by using the separate machines.

BALING-PRESS.—T. A. GOODWYN, Madill, Ind. Ty., and P. E. STOVALL, Waxahachie, Texas. The press is designed particularly for baling hay, but may be used in connection with other materials also. It comprises three rollers working the material between them to form a round bale, these rollers being arranged in connection with certain peculiar mechanism for discharging the bale and for otherwise controlling the action of the various parts.

Apparatus for Special Purposes.

LOG OR FREIGHT DUMPING APPARATUS.—T. ALEXANDER, Brookhaven, Miss. The chief feature of this apparatus is a pivoted and automatically tiltable frame on which the log strikes and by which it is arrested and then discharged into a suitable receptacle. The frame automatically assumes its normal inclined position immediately following such discharge. Suitable adjustments are provided for different lateral inclinations.

COMBUSTION APPARATUS FOR STEAM BOILERS.—J. E. FRASER, Dayton, Ohio. In the ordinary furnace attachment for steam boilers, all the products of combustion are allowed to escape into the atmosphere. Mr. Fraser has devised an improved apparatus in which the gaseous products of combustion are directed under pressure into the water in the boiler, whereby their heat is utilized in the development of steam.

Electrical Apparatus.

AUTOMATIC CUT-OUT.—G. E. ANDREWS, Providence, R. I. The invention relates to automatic cut-outs, more particularly of the type used in connection with fuse wires. The main purpose of the invention is, first, to short-circuit the mains, and second, if the voltage is high enough, to leave the mains open. The apparatus is preferably located at the point where the wires enter the building and may be used on any circuit of constant potentials.

ELECTRICALLY-OPERATED VALVE-GATE.—A. ORR, Gloversville, N. Y. The improvement relates more particularly to an appliance for opening and closing the so-called "auxiliary valve" generally used in connection with a large main valve. It comprises a valve-stem for operating a valve, and a motor mechanism for actuating this valve-stem, the motor mechanism being provided with an arm which is engaged by a lever normally restraining this motor mechanism. Means controllable at will are also provided for actuating this lever to cause it to momentarily disengage the arm.

ELECTRICAL FLOOR-KEY.—E. C. GOODRICH, Houghton, Mich. The particular object of this invention is to provide an electrical floor key which will obviate unnecessary mutilation of the floor and also prevent the danger of breaking the electrical connections and overturning the table on which are supported the devices to which the electrical connections lead.

Hardware.

WRENCH.—C. J. BARNES, Liverpool, N. Y. Mr. Barnes provides a simple, compact implement adapted to afford a double grip on the work, which will hold itself firmly in engagement with the work against any tendency to slip thereon. The parts may be easily and quickly released preliminary to taking a fresh hold on the object, and will firmly engage with round work of different sizes.

Machines and Mechanical Devices.

MUSIC-LEAF TURNER.—G. E. ADAMS, Glens Falls, N. Y. The device provides a means whereby the leaves of music may be fixed in position to a series of music-carrying arms and held in position after turning until the arms are purposely released, which is accomplished by simply touching the device with the finger. The arms when released from the retaining device will automatically assume a position at the opposite side of the frame, thus turning the leaves with which they are respectively connected.

MACHINE FOR APPLYING COATINGS.—J. B. MCKEOWN, Union Hill, N. J. The invention relates to machines used in the manufacture of mirrors and other articles requiring a coating. It provides a new and improved machine for applying amalgam or other coating material to glass or other surfaces in a very effective and uniform manner and without the employment of skilled labor.

SHOE-LINING TRIMMER.—C. B. CORWIN, Jefferson City, Mo. Mr. Corwin has invented a new machine which is intended to do certain work relating to the trimmings of shoe-linings, this work having been heretofore done by hand. It has been found that the machine will do excellent cutting even with a comparatively dull cutter, provided the same be given a suitable speed. The cutter may be easily detached for the purpose of grinding.

MACHINERY FOR MAKING SLABS WITH PLAIN OR ORNAMENTAL SURFACES OF PLASTIC CEMENT OR COMPOSITION.—G. B. HALL, "Valkyrie," Colney Hatch Lane, Muswell Hill, London, Eng. The invention provides an improved apparatus for making molded slabs of cement or other quick-setting composition for construction of walls, ceilings, roofs, etc., the plastic material being delivered in a continuous stream to a continuous series of molds formed by an endless traveling apron, traveling side fences, and cross division bars.

PLAITING-MACHINE.—M. F. KOCH, New York, N. Y. Mr. Koch is the inventor of improvements in machines for accordion and side plaiting fabrics. The construction of the machine is such, that by its means the successive plaits may be rapidly and evenly formed and pressed.

VARIABLE-SPEED GEAR.—H. F. NORTHROP, New York, N. Y. This variable-speed gear is particularly adapted for use in connection with automobiles. The construction is simple and may be produced at a small cost as compared with speed gear embodying toothed wheels or friction clutches. The device also operates without the shock in starting and stopping incident to meshing gears.

Railway Improvements.

LOADING DEVICE FOR LOCOMOTIVES.—G. HOFFMAN, Fontanet, Ind. The invention provides an efficient means for transferring coal from any elevated storage place to the tender of a locomotive. A movable bin or carrier is mounted upon the upper end of a tilting frame fulcrumed on its lower end and adapted to receive its charge of coal and then to swing forwardly and downwardly to discharge its load into the tender. The invention comprises various features of construction whereby the movements of the carrier and its contents are regulated.

Miscellaneous Inventions.

BOX-FASTENER.—WILLIAM JORDAN, Winona, Minn. The fastening is particularly adapted for securing covers of boxes or crates, especially such as are particularly adapted for the packing of beer in bottles. The invention provides a novel cover which closes the box.

CLOTHES-DRAINER.—HARRIET BLENKHORN, Minneapolis, Minn. The drainer is especially adapted for use on wash-boilers for the purpose of draining the clothes saturated with hot water, thus obviating wetting of the floor. The water is effectually drained from the clothes.

PHOTOGRAPHIC CAMERA.—HENRY W. HALES, Ridgewood, N. J. Mr. Hales' camera is of the type having a movable mirror in front of the sensitized plate to reflect the image onto a ground-glass arranged in the top of the camera. In the usual cameras of this type leakage of light frequently occurs. It is impossible to obtain the desired shutter-speed for instantaneous work, because the air within the camera-casing retards the movement of the shutter. In cameras having a lever mechanism to move the mirror and a focal-plane shutter to uncover the sensitized plate or film, it is essential that the lever mechanism shall finish its movement before the shutter starts. Consequently such a camera is untrustworthy. In Mr. Hales' camera these defects are overcome. All leakage of light is prevented; the speed of the shutter is regulated, and the action of the various parts is positive and quick.

COMBINED SASH-FASTENER AND SHADE-SUPPORT.—EDWARD A. SACKET, Denver, Col. The window-shash attachment has vertical rods connected with the sliding upper sash, which rods pass through clamps on the slidable lower sash. Mr. Sacket has so constructed and combined the various parts of his invention that the rods are adapted for convenient attachment to and detachment from the sockets and clamps applied to the respective sashes. Hence the rods are adapted for receiving and supporting a window-shade roll, which is probably a new feature in inventions of this class.

ICE-SANDAL FOR FLAT HORSESHOES.—ISRAEL G. HOWELL, Hopewell, N. J. This sandal for icy roads is adapted to rest on the underside of a horseshoe, and is provided with points and heels. Bolts secure the sandal to the shoe at about the quarters, a flange on the toe of the sandal engaging a recess on the edge of the toe. The sandal, as will be seen, is detachable and gives the animal a firm foothold on slippery roads.

HORSESHOE.—FRED. SHEELY, Fleischmanns, N. Y. Mr. Sheely provides his horseshoe with calks that can be easily and quickly detached, so that sharp calks can be used for winter weather to prevent the horse from slipping on the ice or frozen ground. Flat-faced calks can be applied to the shoe for summer use.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
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Marine Iron Works. Chicago. Catalogue free.

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"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 3117.—For dealers and manufacturers of asbestos goods.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 15, Montpelier, Vt.

Inquiry No. 3118.—For manufacturers or dealers in machines for manufacturing indurated fiber wire from wood pulp.

Sheet metal, any kind, cut, formed, any shape. Prompt work. Metal Stamping Co. Niagara Falls, N. Y.

Inquiry No. 3119.—For manufacturers of sugar grinding mills.

Die work, experimental work and novelties manufactured. American Hardware Mfg. Co., Ottawa, Ill.

Inquiry No. 3120.—For manufacturers or dealers in rubber novelties, such as balloons, rubber balls, etc.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 3121.—For an electro-plating outfit.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 3122.—For machinery for making tin fruit and jam cans.

IDEAS DEVELOPED.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 3123.—For manufacturers of double-action water pumps.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3124.—For manufacturers of incandescent gasoline lamps.

Patents developed and manufactured, dies, special tools, metal stamping and screw-machine work. Metal Novelty Works Co., 45-47 S. Canal St., Chicago.

Inquiry No. 3125.—For manufacturers of cook stoves using coal oil or gasoline as fuel.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3126.—For manufacturers of self-heating flat irons.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 3127.—For manufacturers of engines of about 100 horse power using oil as fuel.

FOREMAN BOILER MAKER WANTED.—First class man wanted for a modern shop building marine and stationary boilers, and doing boiler and iron ship repairs. Applicants will please state age, experience, nationality, and give names of previous employers. This is a good position for a good man. Address P. O. Box, 2785, Boston.

Inquiry No. 3128.—For manufacturers of the Columbia aither.

WANTED.—Engineer to plan and superintend the erection of additions to our manufacturing plant, which we are making from time to time, the arrangement and erection of machinery, shafting, power plant, heating apparatus, etc. Permanent position. State age, experience, references and salary wanted. Address The Ohio Brass Company, Mansfield, Ohio.

Inquiry No. 3129.—For manufacturers of soft sheet rubber.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Bldg., Rochester, N. Y.

Inquiry No. 3130.—For manufacturers of collar buttons.

Inquiry No. 3131.—For manufacturers of the small hand mirror with puzzle on back.

Inquiry No. 3132.—For a plant for the manufacture of steel freight cars.

Inquiry No. 3133.—For manufacturers of wooden hand rakes.

Inquiry No 3134.—For dealers in dried herbs and roots.

Inquiry No. 3135.—For manufacturers of a machine for winding telephone magneto coils.

Inquiry No. 3136.—For machines for cutting straw for bushel baskets.

Inquiry No. 3137.—For manufacturers of laundry machinery.

Inquiry No. 3138.—For manufacturers of stamped goods of German silver, or some white metal less expensive than aluminium.

Inquiry No. 3139.—For manufacturers of six-penny sticks of wolduminium, patented by Power & Webster, said to be manufactured by W. W. Armstrong.

Inquiry No. 3140.—For manufacturers of heads and handles for feather dusters.

Inquiry No. 3141.—For manufacturers of a machine for assorting bristle hair.

Inquiry No. 3142.—For manufacturers of a machine for separating natural gas from water.

Inquiry No. 3143.—For manufacturers of chuck saws.

Inquiry No. 3144.—For manufacturers of light, portable printing presses.

Inquiry No. 3145.—For manufacturers of track velocipedes for railroad inspection.

Inquiry No. 3146.—For a machine for darning stockings.

Inquiry No. 3147.—For manufacturers of acetylene gas engines.

Inquiry No. 3148.—For manufacturers of patented novelties for mail order business.

Inquiry No. 3149.—For a machine for sawing and splitting wood for cooking stoves.

Inquiry No. 3150.—For manufacturers of small tin cans for retaining liquids.

Inquiry No. 3151.—For manufacturers of telegraph insulators.

Inquiry No. 3152.—For manufacturers of machinery for cutting excelsior.

Inquiry No. 3153.—For manufacturers of portable houses.

Inquiry No. 3154.—For manufacturers of broom-making machinery.

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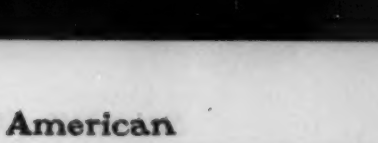

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled

(8677) W. L. J. asks for an acid-proof cement; preferably one which will stand a reasonably high temperature. A. Try a putty made of litharge and glycerin.

(8678) L. A. D. writes: I am a stereotyper. What will I put in paste to make the matrix hard after it is dry? Give me a recipe for backing powder. What is the cause of blow holes in plate and cure for it? A. Paper matrices for making stereotype plates from type forms, used in newspaper offices, are prepared as follows: Make a jelly paste of flour, starch and whiting. Dampen a sheet of soft blotting paper, cover its surface with the paste, lay thereon a sheet of fine tissue paper, cover the surface with paste, and so on until four to six sheets of the tissue paper have been laid on. The combined sheets thus made is then placed, tissue face down, upon the form of types, which are previously dusted with whiting, and with a brush driven down upon the types and thereon allowed to dry. The operation of drying is facilitated by having the types warmed by placing them upon a steam heated table. A blanket is placed over the paper during the drying operation. Probably thorough drying will avoid the difficulty you mention.

(8679) W. S. S. asks for a recipe for a soap to clean woodwork that will not injure the finish or varnish or paint, but at the same time remove the dirt. Also if such a soap will do the work should like it for cleaning carpets or rugs so that same will not be left sticky and stiff. Understand there are receipts for such soaps. A. To clean paint, provide a plate with some of the best whiting to be had; have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, and apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which, wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor. To clean paint, take 1 ounce pulverized borax, 1 pound small pieces best brown soap, and 3 quarts water; let simmer till the soap is dissolved, stirring frequently. Do not let it boil. Use with a piece of old flannel, and rinse off as soon as the paint is clean. This mixture is also good for washing clothes. This would probably answer for cleaning rugs.

(8680) J. H. W. asks: Can you tell me in your query department what is the best size wire for the secondary winding of a spark coil for a gas engine. Could the secondary wire be too fine? Have you a good book on the subject? A. Very rarely is any number of wire less than No. 36, A. W. G. silk covered, used in the secondary of induction coils. The secondary cannot be too fine. We recommend upon this subject Norrie's Induction Coils, price $1 by mail.

(8681) A. M. L. asks: Kindly inform me through the SCIENTIFIC AMERICAN: 1. What substances best conduct sound? A. If by best conductors is meant those through which sound travels most rapidly, the answer as given in Zahm's Sound and Music, price $2.50 by mail, is steel, 15,470 feet per second; iron, 16,822 feet; fir wood, lengthwise the fiber, 15,218 feet; aspen, wood, along the fiber, 16,677 feet; white pine, 17,200 feet. Chladni obtained a velocity for fir much greater than that given, 19,685 feet. 2. What substances are most opaque to heat? A. Kent, Engineers Pocket Book, price $5, gives as the result of tests with heat at 310 deg. F. a list of 32 articles, of which the best four are loose wool, live geese feathers, loose lampblack, and hair felt. Of course these are all combustible, to an extent. Of covering materials, for instance, to protect ice from melting, mineral wool and hair felt are the best. In protecting liquid air from external heat to prevent evaporation a vacuum as perfect as possible has proved to be the best insulator. 3. What substances are most incombustible? A. A brick is probably the most incombustible thing. It has been once burned in a kiln till everything com-

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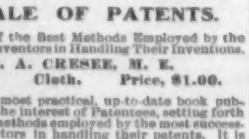

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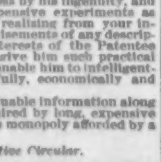

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bustible in it is destroyed. Volcanic lavas are also incombustible. Furnace slag is of the same character.

(8682) J. M. C. asks: How many watts a 16 candle power incandescent light will use? A. Sixteen candle power lamps of different types use from three to four watts per candle.

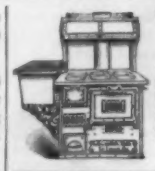
(8683) H. W. C. asks: Please advise me as to what book you recommend on designing of motors of the two-pole Edison type, with points as to effect of change of area of poles, position of greatest pull, etc., price of same and where to be had. Will Parkhurst's $1 work cover it? A. For the principles of designing of motors on direct current we recommend Thompson's "Dynamo Electric Machinery," price $6, as the leading authority. Hawkins and Wallis' "Dynamo," price $3, discusses the principles of the machine. Wiener's "Designing of Dynamos and Motors," price $3 last edition, is considered a reliable work. Parkhurst's little book, price $1, contains the plans and details of two little motors which he designed. It has no instruction in reference to the mode of designing. The book "Electrical Designs," price $2, contains a large number of plans of machines, some of which would probably be useful to you. The only way to learn the art of designing thoroughly is to take a course of electrical engineering and then work in the shops of some one of the great electrical companies. You will then become a designer with originality in your designs.

(8684) K. G. B asks: 1. Will you kindly inform me through your valued paper whether there is any way of finding the "constant" of a Thompson recording wattmeter from the type, class, etc., as stamped on the metal plate attached to it? To illustrate: What would be the constant of a Thompson wattmeter Type M. Form E-3, Class 50, 220 Volts? The constant on these meters is always marked in ink, which makes it easy for electric light companies, if they are inclined that way, to change it to a higher figure, thus making the meter register more current than is consumed in reality. A. The constant of a Thompson recording wattmeter may be roughly verified by the following method: Turn on a number of lamps of a rated number of watts. Multiply the watts per lamp by the number of lamps. Observe the number of seconds required for a revolution of the disk, and multiply the watts used by the number of seconds per revolution of disk. Divide this product by 3,600, the number of seconds in an hour. The quotient is the constant required. If a stop watch is used the seconds per revolution can be found with great accuracy. The reason this is only a rough method is that lamps as they grow old take more than their rated number of watts. The meter is not liable to over-record the service, since the disk is not likely to run too fast. A better way is to connect an accurate wattmeter in series with the recording meter to be tested and compare the readings. 2. Is there any book or manufacturer's catalogue that will give accurate information on this subject? 2. Foster's "Electrical Engineer's Pocket Book," price $5 by mail, and the circulars of the manufacturers.

(8685) H. H. asks: Kindly advise me of the method used for grinding glass for the mirrors of reflecting telescopes; I mean more particularly the means of describing the curve before beginning. Also if there is not a more practical way of getting a parabolic curve than that given in most text-books, which simply say it is the focus of a point equi-distant from the focus and directrix? I understand the theory well enough, but often wonder if opticians have no more practical way of getting at it than constructing perpendiculars to the directrix and measuring to the focus; also if in getting at a spherical curve of, say, fifteen feet radius, it would be necessary to use a compass or stick of that length to construct it? If you know of any publication that would give me this information will you kindly let me know of it? A. A paraboln is most correctly described by locating a sufficient number of points on the curve and passing a line through these points. Kent's "Engineer's Pocket Book," price $5, gives four methods of describing a parabola. In shops the curves required are first described of full size and a template is made for use in work. Lofts or floors of sufficient size are necessary. For grinding lenses forms are turned and used in the machine or by hand to shape the glass. "Orford's Lens Work for Amateurs" gives instructions in this work.

(8686) N. J. R. asks: What are the proper proportions of gas and air to use for the greatest explosive force of acetylene, gasoline and crude oil gas. A. The strongest explosive power of acetylene gas is made by a mixture of 1 part acetylene to 9 parts air; of gasoline vapor, 1 part vapor to 8 parts air; crude oil illuminating gas, 1 part gas to 6 of air. See Hiscox's book on "Gas, Gasoline and Oil Engines," $2.50 by mail.

(8687) D. P. asks: A says that the mechanical advantage of a movable pulley is due to the fact that it is a second-class lever. B says that the mechanical advantage is in the rope. A. The movable pulley is a second-class lever and the source of power. The rope is only the medium of its application. A is correct.



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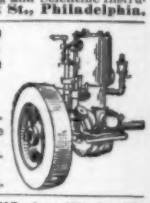

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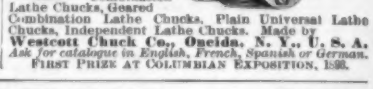

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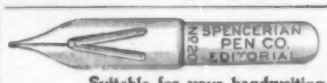

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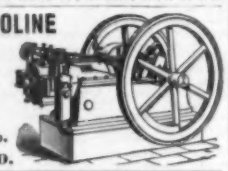

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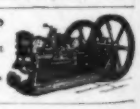

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In 1888 Mr. Tuckerman published a bibliography of the literature of the spectroscope. The present volume is a continuation of that bibliography and brings the work down to 1900.

IN MY VICARAGE GARDEN AND ELSEWHERE. By Rev. Henry N. Ellacombe, M. A. The Bodley Head, London and New York: John Lane. 1901. 16mo. Pp. 220.

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THE BOOK OF VEGETABLES. By George Wythes, V.M.H. Together with Chapters on the History and Cookery of Vegetables. By the Editor. The Bodley Head, London and New York: John Lane. 1902. 16mo. Pp. xii-106.

This is a practical book written by a practical man, covering the subject of vegetable culture concisely and thoroughly. Not only does the author tell us how garden vegetables should be grown, but he even tells something of their history and a good deal of how they should be cooked.

IRRIGATION FARMING. A Handbook for the Proper Application of Water in the Production of Crops. By Lucius M. Wilcox. New York: Orange Judd Company. 1902. 16mo. Pp. vii-494.

The present work is a revised edition of "Irrigation Farming." A revision has been rendered necessary by the improved methods which have been devised and adopted within recent years. The author is counted an authority on the subject, and discloses the theory and practice of irrigation in a way that is certain and clear.

ELECTRICAL AND MAGNETIC CALCULATIONS. By A. A. Atkinson, M.S. New York: D. Van Nostrand Company. 1902. 16mo. Pp. vii-310. Price $1.50.

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THE SMOKE PROBLEM. By Richard J. McCarthy. Reprinted by the Kansas City Southern Railway Company for information of enginemen. Pp. 24.

MAGNETISMO E ELETTRICITA. By Francesco Grassi. Milan: Ulrico Hoepli, publisher. 1902. Pp. xv-608.

DECADENCE OF THE VULGAR FRACTION. By Rufus P. Williams. Pp. 7.

THE RAILROAD AS AN ELEMENT IN EDUCATION. Revised and Enlarged with new illustrations. By Prof. Alex. Hogg, M.A. Louisville, Ky.: John P. Morton & Company. 1899. Pp. 112.

IMPERIAL UNIVERSITY OF TOKYO. The Calendar, 1901-1902. Toyko: Published by the University. 1902. Pp. v-328.

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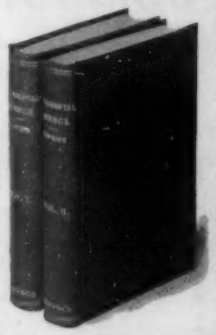
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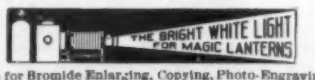

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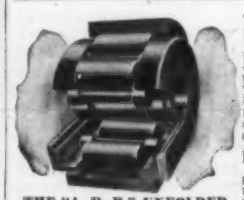

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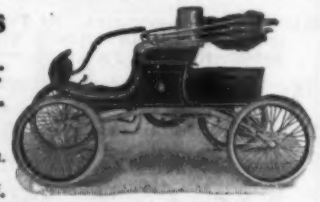

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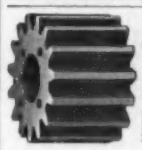

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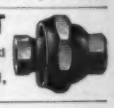

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